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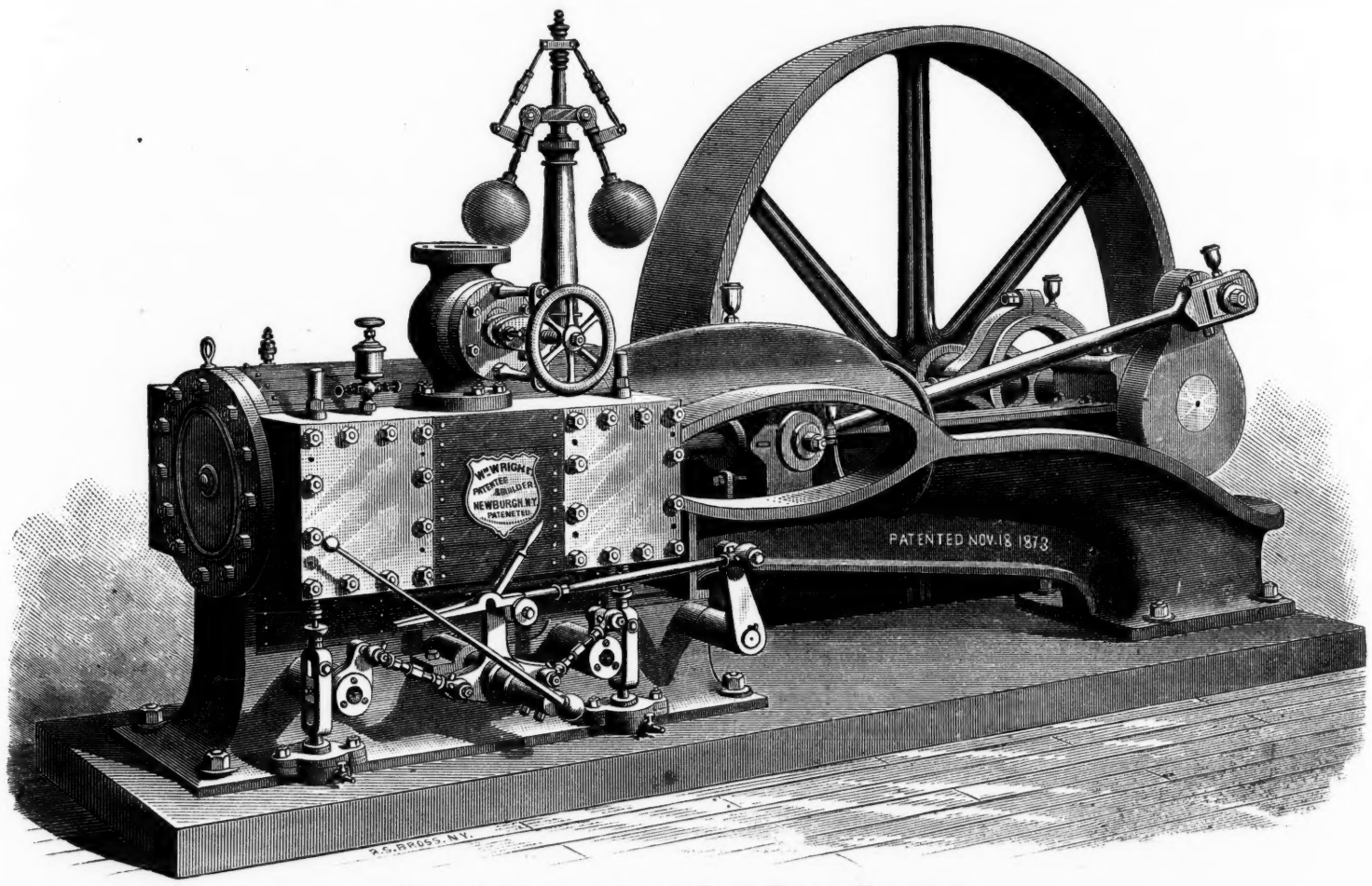
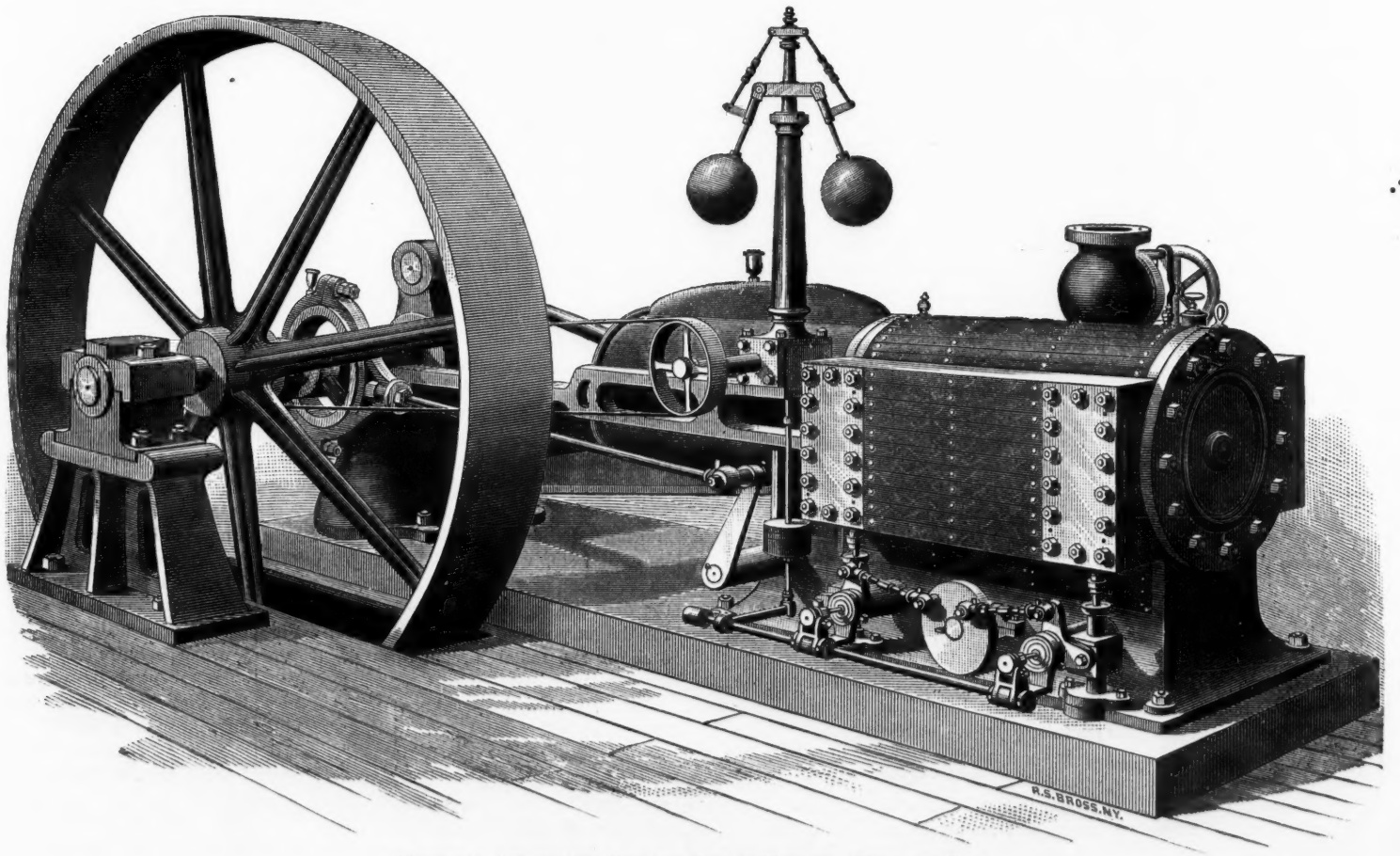


WRIGHT'S AUTOMATIC CUT-OFF STEAM ENGINE—STEAM SIDE.



WRIGHT'S AUTOMATIC CUT-OFF STEAM ENGINE—EXHAUST SIDE.

179903

The "Wright Patent Steam Engine,"

WITH AUTOMATIC CUT-OFF VALVE GEAR.

We present herewith two views of Wright's Celebrated Steam Engine, and direct attention to a few facts as to its design, construction, and operation; and by reference to the cuts on the first page, one will immediately notice the improvements made in design and in simplicity since its first introduction to the public by Mr. Wright some thirty years ago.

In the two illustrations, one of which shows the steam side, with cut-off valve gear, and the other shows the exhaust side of the engine, the eye is immediately attracted to the peculiar construction of the bed-plate frame. The portion of the frame, which, in ordinary engines, is devoted to the usual flat slides, consists of a hollow cylinder arranged concentrically with the steam cylinder, and serves as a guide for the cross-head, the guiding cylinder, being simply bored out to receive the cross-head.

There are lateral openings in this cylindrical guiding portion of the frame in order that access may be had to the cross-head and stuffing box of the piston rod. It will be readily understood by those familar with the costly fitting and other preparations demanded by the slides of ordinary horizontal engines, that this combination conduces to simplicity, strength and economy in the construction of the frame.

From the front of the guiding cylinder, or slides, to the point where it meets the base, the frame is made in the form of an inclined concavo-convex trough, deep enough to permit the free movement of the connecting rod. The trough has the upper edge of one side continued in a plane, coinciding with the center of the cylinder, from the latter to the enlargement for receiving the bearing of the crank-shaft. The opposite side of the trough extending from the guiding cylinder with a gradually descending curve to the base, into the upper portion of which it merges. In horizontal engines, there is, necessarily, an excessive lateral strain on the frame between the cross-head guide and the crank-shaft. This strain is effectually resisted by the proper distribution of the material in the construction of this bed-plate.

The steam cylinder itself rests on a separate bed-plate to which it is securely bolted, the bottom of which is at the same level with the pillow-block and of the bed-plate. This cylinder-foot carries all necessary rocker-shafts for the valve gear.

There are four valves, known as the grid-iron slide valves, which work vertically in chests cast with the cylinder, two upon one side of the cylinder being for induction, or cut-off, and two upon the opposite side being for eduction, or exhaust steam.

All valve motion is derived from a single eccentric, which operates levers, so arranged as to give quick opening movement to valves when opening, and also a very slow movement when valves are lapped. The location of all these valve-faces close to the bore of cylinder insures the least possible amount of clearances. The steam valve-stems are fastened in yokes, which have at their lower ends plungers fitted in dashpots, the same acting as guides; the yokes are operated by steel slides fitted through the end of hollow rocker-arms, and which act upon the swinging toes held in the yokes, the said slides having a diagonal slot in which works a feather, this feather being made on a rod which has a longitudinal movement through the hollow rocker-arm, and to which the governor is connected. By this longitudinal motion, and through the diagonal feather and slot, the slide is automatically set, to engage more or less with the swinging toes, and which gives the valve its proper lift, and liberates upon the chord of the arch. The governor itself stands on a bracket or shelf, cast on the slide part of the bed-plate, and the governor rod is connected to a lever, which is fastened to the governor-shaft. This same shaft carries two forked arms which take hold of the small rods running through the hollow rocker-shafts. The rods are enlarged at their other ends, where they carry the adjustable slides mentioned before.

The advantages in this arrangement of valves and valve-gearing are easy accessibility to each valve, by the simple removal of a bonnet, and the very important and desirable fact is, that the whole of the valve-gear and governor connections is outside of the steam-chests where any derangement can be at once seen and rectified.

The steam piston is fitted with steam packing rings, and a brass shoe reaching around the lower half of the piston, and is adjustable by set-screws to carry the weight of the piston. The piston-rod, crank, and cross-head, pins, valve-stems, and all smaller wrist-pins, and all heads of connections, are made of steel, all connections have adjustable brass boxes. The cross-head, which is made of cast iron, has a large shoe at top and bottom, lined with anti-friction metal, fitted to the bore of the slide, and is adjustable by wedges and set-screws to take up the wear.

The connecting-rod is made of best hammered wrought iron, with composition boxes at each end; the crank-shaft is made of best hammered wrought iron, has long bearings, one in the main bed-plate, and one in an outside piliow-block, both lined with anti-friction metal, and the main-bearing with adjustable side-boxes.

This engine will maintain its uniform speed with a very slight variation, changing, between its maximum and minimum load, as near as can be attained by any automatic regulation; it will carry out the law of expansion, according to the theory established by science, as nearly perfect as has ever been done, and by its superiority in proportions, compactness, durability and arrangement of parts for accessibility for repairs commends itself to all practical engineers.

These engines are built exclusively at the Wright Steam Engine Works, Newburgh, N. Y., under the personal supervision of Mr. Wm. Wright, the inventor and patentee of the engine. All letters for further information to be addressed to the works at Newburgh, N. Y.

Mr. Wright was superintendent of the shop when the first Automatic Cut-Off Engine was made, and took an important part in the designing and construction of the same, introducing many valuable suggestions which were adopted, and are in use at the present time. In making changes in steam engines he has always been a leader, not an imitator. A full history of his improvements in the steam engine, which have everywhere been recognized by engineers, as important and valuable, would fill a large volume. Suffice it that the type of engine, shown on our first page, embodies those special features which his thirty years' experience has proved most desirable.

Defects in the Construction of Steam Boilers.

BY STEPHEN ROPER, ENGINEER.

About a quarter of a century ago a terrific boiler explosion occurred at Hartford, Conn., by which twenty men lost their lives. The boiler was a new one, and had just been put into service. The cause of the disaster was ventilated by three sets of *experts*; one claiming that the water was dangerously low, and that the iron was burned; another asserted that the iron was of an inferior quality, and totally unfit to withstand the strains to which it was subjected; while the third claimed that the disaster was produced by some mysterious agent, or phenomenon, over which, neither the manufacturers of the boiler, nor the attendants had any control. Neither party made any attempt to ascertain whether the material was faulty or not, or whether it had suffered injury in the bending, drifting, riveting, or calking, or whether the boiler was sufficiently braced. In their blind anxiety to establish their pet theories, both parties lost sight of these important points, or else, entirely ignored them.

Several reliable and intelligent persons testified that there was a sufficient quantity of water in the boiler at the time of the explosion, and an intelligent blacksmith took a piece of the iron of the exploded boiler and made sufficient nails out of it to shoe a pair of draught horses. He asserted that the iron was equal, in point of toughness, and tensile strength, to any he had ever used for the same purpose. In the face of such conflicting testimony what could the Coroner's jury do but render a verdict that, in their opinion, the deceased came to their *death* by steam.

The annexed cuts illustrate some of the mechanical defects that impair the strength and limit the safety and durability of steam boilers. All punched holes are conical, and unless the sheets are reversed, after being punched, so as to bring the small sides of the holes together, it will be impossible to fill them with the rivets.

Fig. 1, shows the position of the rivet in the hole, without the sheets being reversed, and it will be observed, that as very little of the rivet bears against the material, the expansion and contraction of the boiler have a tendency to work it loose. It is apparent that such a seam would not possess over one-third the strength what it would have if the holes in the sheets were reversed and thoroughly filled with the rivet as shown in Fig. 2. Fig. 3 represents what is known in

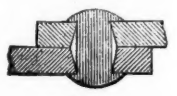


FIG. 1.

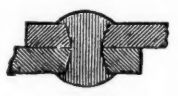


FIG. 2.

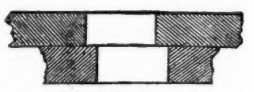


FIG. 3.

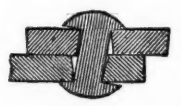


FIG. 4.

FIG. 5.

FIG. 6.

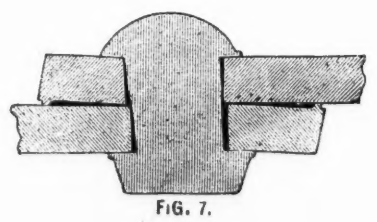


FIG. 7.

boiler-making as a blind hole, which means that the holes do not come opposite each other when the reams are placed together for the purpose of riveting. Fig. 4 shows the position of the rivet in the blind hole after being driven. It will be observed that the heads of the rivet, in consequence of its oblique position in the hole, bear only on one side, and that even there, the bearing is very limited, and, through the expansion and contraction of the boiler is liable to work loose and become leaky. Such a seam would be actually weaker than that represented by Fig. 1. Fig. 5 shows the metal distressed and puckered on each side of the blind hole in the sheets, which is the result of efforts on the part of the boiler maker, by use of the drift-pin, to make the holes correspond, for the purpose of inserting the rivet. Fig. 6 shows the metal broken through, by the same means.

Fig. 7 shows the weakness induced by a mischievous system of calking, in which only a small portion of the material is composed, or upset, and by which the overlapping seams are forced apart, and their friction, or cohesion, destroyed.

Although a boiler caulked in this way may be steam and water tight, when first put under pressure, it will not remain so long, as the expansion and contraction of the seam will soon compress the sharp burrs raised by the caulking tool, and allow the seam to become loose.

Owing to the contraction of the rivets in cooling, the plates are, in many instances, brought into such close contact, that the friction between them is sufficient to withstand the working strain without any shearing action coming upon the rivets. This is more especially the case with machine riveting. The contraction of a wrought iron bar in cooling is nearly equal to $\frac{1}{10000}$ th of its length, since a decrease of temperature of 15 degrees Fah., and the strain thus induced is about one ton for every square inch of sectional area in the bar.

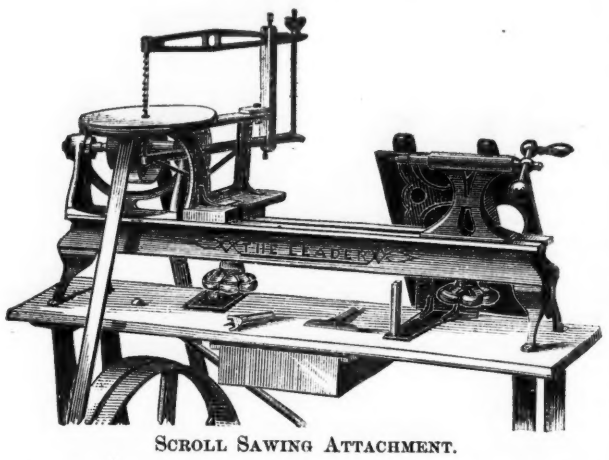
Thus, if a rivet 1-inch in section were closed at a temperature of 900 degrees, it would, in cooling, decrease in length $\frac{60}{10000}$ ths of its length; and, if its elasticity and strength remained perfect, would produce a tension of 60 tons. The ultimate strength of rivet iron however, being only 24 tons, the rivet would, in cooling, be permanently elongated, and would continue, when cool, to exert a tension of 24 tons, providing its elasticity remained uninjured by the strain. Thus, if the rivets were not in contact with the plates, excepting at the head and tail, the plates would be held together by a pressure of 24 tons, and this friction would have to be overcome before the rivet came into action as a mere pin, from which it wil lbe seen that by judicious riveting the friction may, in many cases, be nearly sufficient to counterbalance the weakening of the plate from the punching of the holes. Now, it will be observed, that nearly all the above defects are the result of ignorance and carelessness, showing a want of skill in laying out the work, as well as a want of proper appliances for that purpose. The evils arising from such defects are greatly aggravated by the fact that they are all concealed, frequently defying the closest scrutiny and are only revealed by those forces, which, increasingly act on boilers when in use. Such pernicious mechanical blunders ought to be condemned, as they are always the forerunners of destruction and death. No doubt, numerous boiler explosions occur from defects similar to those illustrated in this article.

Steam Engine Economy—A Uniform Basis for Comparison.

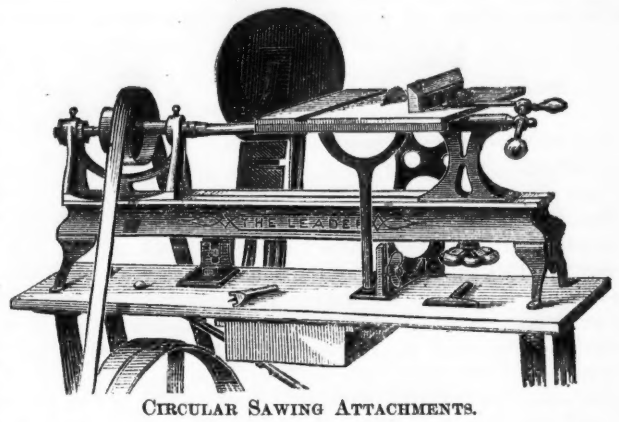
A PAPER BY CHARLES E. EMERY, M.E., MEMBER OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

Concluded.

In the pumping-engine for use on land there were no restrictions as to weight and space, so a comparatively long stroke could be employed and the connections made through a beam. The marine engine had, however, to be located in a small vessel, and was therefore directly connected and proportioned accordingly. Yet the long-stroke engine was run with so much expansion and at so slow a speed as to develop less power than the smaller one, and the latter was less economical, on account of the lower steam pressure and rate of expansion and the relatively greater proportion of waste room in the cylinder, incident to the necessary use of ordinary slide-valves. The engine of the *Rush* was, however, more economical than the ordinary stationary compound engines used for manufacturing purposes, as the latter, according to published reports in the engineering journals, require the evaporation of not less than 20 pounds of water for each indicated horse-power. The Lawrence engine contains all well known means for securing maximum economy of steam, and it is probable that few, if any, engines are working with greater economy in respect to the indicated power. The performance is, however, much below that given by calculation when all the conditions are taken into consideration, other



SCROLL SAWING ATTACHMENT.



CIRCULAR SAWING ATTACHMENTS.

This wrench is designed for the use of machinists, tool makers, amateurs and adjusters of machinery generally, who require to have a wrench constantly by them. The sliding bar being graduated into thirty-seconds of an inch, makes it a tool that will be appreciated by tool-makers, machinists, &c. There have been many devices brought before the public for a handy wrench that could be carried in the pocket, but either from the cheap material used in their construction, or their complication, they have not met with general favor. In projecting this wrench the designer has overcome objections heretofore existing, and has produced a wrench unequaled in material, finish, strength, and efficiency, and is warranted in all respects a first-class article. The wrench was designed by Mr. C. E. Billings. For further particulars, address The Billings & Spencer Co., Hartford, Conn. U. S. A.

than the slight distortion of the theoretical indicator diagram found in practice and the important loss due to cylinder condensation.

In an engine using a total pressure of (90 + 44.7 =) 104.7 pounds expanded 13.5 times in a cylinder, with clearances, etc., equal to .02 of the displacement, the calculated cost of one horse-power per hour, or 1,980,000 foot-pounds, should only be 8.12 pounds of water evaporated from the initial pressure, on the basis that the curve of expansion is hyperbolic, and that the consumption of steam equals the volume at the initial pressure, required to fill the cylinder to the point of suppression, plus that condensed for the total work. With a pressure of 100 pounds above the atmosphere, and an expansion of 20 times, there should be required on the same basis the evaporation of only 6 00 pounds of water per indicated horse-power per hour. It is probable that the practical results obtained with the latter pressure and expansion would be little or no better than those from the Lawrence engine, on account of the greater cylinder condensation due to the increased expansion.

The above calculated performances, and the practical results obtained with engines and other steam machinery of various kinds, is shown in the accompanying table, in connection with the relative efficiencies obtained by considering the heat-units in the steam and the calorific value of the fuel. The table and a portion of the above are from the report previously mentioned, and the refere n ces are to pages therein.

The Leader Lathe.

Herewith is illustrated a new type of foot lathe, substantially made, combining simplicity and durability, at a remarkably low price. The bed, head, and tail stocks are of iron. The spindles of steel. The bearing of the head stock is conical, so that the wear can be easily taken up The head spindle-step is self-lubricating.

The head spindle is ground true in its bearings.

The tail stock can be adjusted for wear by means of a nut.

The treadle hangs on socket centers.

Material 18 in. long and 8 in. diameter can be turned on it. Accompanying the lathe are two T rests, two plain centers, one spur center for wood turning, and one face-plate. The bench is made of iron, with a walnut top for holding tools. If desired, the lathe is furnished with a hollow spindle.

The Circular Sawing Attachment shown in cut, has a table of iron, planed true, and can be adjusted as to height. It has a guide running in a groove at right angles with the saw, and a slide operated in a similar groove paraliel to the saw. The slide can also be adjusted to different angles.

The Scroll Sawing Attachment is moved by a pitman connecting it with the face-plate by a small stud. The bolt of the T rest-holder is used for fastening this attachment to the lathe, and when not in use, it can be thrown back behind the shears, without entirely removing from the lathe, unless so desired. The sale of the Leader Lathe and its attachments is controlled by Frasse & Co., 62 Chatham St , New York.

The Newark Steel Works are running double turn, both old and new mills, with an increasing business.

Annual Report of the Hartford Boiler Insurance Co. for 1877.

As we go to press a copy of the annual report, just published, of the Hartford Boiler Insurance Comp'y, reaches us. It is a pamphlet of 22 pages, reciting the work of the Company for 1877, pointing out errors of boiler makers and steam users, and reviewing the boiler explosions of the year, aided by 14 engravings. We make the following extract from the summary of work, and will give more copious extracts from other portions of the report in our next

During the year ending Dec. 31, 1877, the Hartford Steam Boiler Inspection and Insurance Company made 11,629 internal inspections of steam boilers, and 32,975 external examinations ; 2,367 new boilers were tested by hydraulic pressure. By these examinations, 15,964 defects were discovered, of which 3,690 were regarded as of a serious character, and required immediate attention. We are not prepared to say that every one would have resulted in a "boiler explosion," but they were of such a character that we required repairs at once. They were as follows, viz.: Furnaces out of shape, 709—85 dangerous. These defects arose from a variety of causes. Boilers urged beyond their capacity are very liable to show this defect. The plates are contorted and "buckled," the seams are strained, and general weakness becomes evident. There is *no economy* in overworking a boiler; better by far increase the boiler capacity, and then the work will be performed with ease and safety. Scale and sediment upon the fire-sheets of a boiler prevent the free transmission of heat, and the iron is burned and weakened. Fractures of plates in, at or near the seams or through the line of rivets, 1,190—of which 517 were regarded as dangerous. Burned plates, 1,112 —337 dangerous. These defects are caused by the same circumstances as those which cause the distortion of furnace sheets. Blistered plates, 2,602—357 dangerous.

Cases of sediment and deposit, 2,005—440 dangerous. Incrustation and scale. 2,621—341 dangerous. These are difficulties which are common to boilers all over the country.

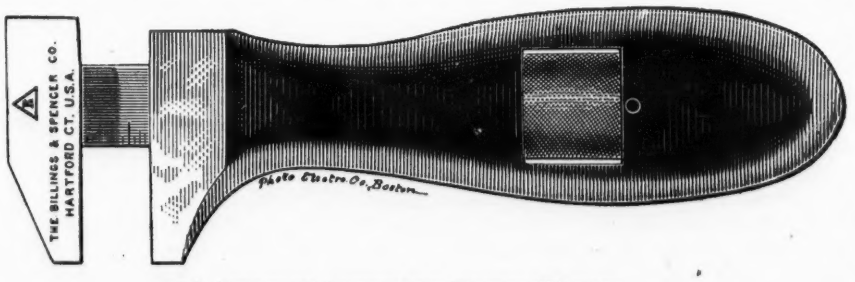
This subject was treated quite fully in my Reports of 1873–74, to which we refer the reader.

External corrosion, 1,063—366 dangerous. Internal corrosion, 173—39 dangerous. Water-gauges defective, 533—143 dangerous. Blow-out defective, 256—96 dangerous. Safety-valves overloaded, 383--158 dangerous There is probably no boiler attachment more tampered with than the safety-valve. It is overloaded, tied down, or, from want of attention, allowed to corrode in its seat, and yet it is called a "*Safety-valve.*" It is an attachment that should have the most careful attention at all times. Pressure-gauges defective, 1,623—403 dangerous.

Most engineers place great reliance on the steam-gauge, and so long as the pressure does not exceed the required limit they think all is safe. But when an examination of the gauge is made, and it is found *not* to show the actual pressure of steam, but instead some thirty or forty pounds less, and that the boilers are under one hundred and ten or one hundred and twenty pounds pressure instead of eighty pounds, it becomes a serious matter. This is no imaginary condition of things, but one which frequently comes up in our experience. Hence the importance of examining steam-gauges and comparing them with one known to be correct. We have found 615 boilers without gauges during the year, but as most of them were running at pressures very little above the atmosphere, we account only six as immediately dangerous. Cases of deficiency of water, 101—43 dangerous. Broken braces and stays, 378—216 dangerous. These defects were found by internal examinations. No superficial inspection or hydrostatic test simply will discover such defects. And from want of a careful internal inspection, boilers greatly weakened by internal corrosion or broken braces and stays are pronounced *sound, and in good and safe condition.*

During the year 133 boilers were condemned as unsafe to use and beyond repair.

LEADER LATHE.



BILLINGS' ADJUSTABLE POCKET WRENCH.

Billings' Adjustable Pocket Wrench.

Herewith is illustrated the Billings Adjustable Pocket Wrench, which is drop-forged from the best Norway iron and bar steel, finished in a thorough manner and case hardened.

Books Received.

A practieal Treatise on Casting and Founding. Including Descriptions of the Modern Machinery Employed in the Art. By N. E. Spretson, Engineer. E. & F. N. Spon, London, and 446 Broome St., New York.

The volume bearing the above title contains 412 octavo pages, and 82 full page plates.

The work presents a large amount of plain, practical information for the iron and brass founder, which is intended to aid him in his employment. There are no abstruse formulæ, but everything is written clearly and concisely, To quote from the preface: "The object of this work has been to collect in one volume every subject on which it is probable that a founder will require information, in whatever material he deals with." The information is brought down to the latest date, and the plates render the descriptions easily understood.

The only addition that we could suggest would be a chapter on making castings of steel. The author has certainly covered extensive ground, and the work shows his familiarity with the best American, as well as English foundry appliances.

Wrinkles and Recipes. (Thirteenth Edition.) John Wiley & Sons, 15 Astor Place, New York.

This is a volume of 300 pages, containing a collection of practical suggestions for the mechanic, the engineer, the farmer, and the housekeeper. The work was first published some two or three years ago, and has been very favorably received. The present edition contains many additions. The general revision of the department of Engineering has been performed by Prof. R. H. Thurston, and a large part of the matter in the department of Mechanics is furnished by Mr. Joshua Rose. The editor of the work is Mr. Park Benjamin. It is amply illustrated.

An interesting and practical article, by Lewis F. Lyne, Me., is presented on this month, entitled, "A Practical Method of Setting the Valves of a Locomotive." It will be easily understood by means of the drawings exhibited. On the opposite page may be found a well-prepared article on "Defects in the Construction of Steam Boilers," by Stephen Roper, Engineer.

During a dense fog a Mississippi steamboat took landing. A traveler, anxious to go ahead, came to the unperturbed manager and asked why they stopped. "Too much fog; can't see the river." "But you can see the stars over head." "Yes," replied the urbane pilot, "but until the biler busts we ain't going that way." The passenger went to bed.

Practical Method of Setting the Valves of a Locomotive.

BY LEWIS F. LYNE, M. E.

Before entering into a practical consideration of the subject before us, it may be proper to state the object of the writer in offering a paper on the subject of Slide Valves, from the fact that there has been so many previously placed before the public on the same subject; but the writers of these papers have failed to give the plain and practical instructions so much desired by the machinist. How often have we heard the desire expressed by this class of men for plain instruction, and it is our object to avoid all technical terms, and place in the hands of the machinist in the shop a course of instruction so plain that if they were spread before him, and strictly adhered to, any man of ordinary intelligence would be able to set the valves of a locomotive within a reasonable amount of time, and in a satisfactory manner. It is not our purpose to go into the details of designing and laying out the valve motion, for space will not permit; and besides it can be found in any good book on the locomotive, so we will only consider, at this time, the series of operations performed in adjusting the valves. Conceive, then, that the engine has been placed upon the wheels. The wedges set up, links hung, and valve rods connected. The first step, under these circumstances, is to mark off the valve, which is done after the following manner: Move the valve back so as to open the front port, then move it ahead until it will admit a piece of the thinnest tin in the edge of the port; then, from the point C, Fig. 1, made with a center punch with a steel tram F, usually about 7 in. in length, describe a short arc on the valve stem and mark permanently with a center punch at B. Through this point draw a line parallel to the valve stem. Move the valve forward so as to open the back port, and then move it back until it will admit tin as in the previous directions, and from the point C, as before, describe the arc E, also put a permanent mark at E, care being taken to make these points correspond with the points of the tram. These points will show the position of valve when the cover is put on the steam chest. We must now satisfy ourselves that the reach rod is the right length by throwing the lever in the forward notch. Set the links plumb and measure from top of the link block to top of the slot in link, throw the lever in the back notch, set the links plumb and measure from bottom of block to bottom of slot in link; these measurements will show if the links hang high or low.

Practice has demonstrated that it is better to hang the links $\frac{1}{8}$ in. high, as the wear is all down on the different parts. Care should be taken to take these measurements on both links, as it often occurs even on new work, that one link will hang higher than the other for various reasons, sometimes, owing to a depression in one frame. If this is found to be the case, and the variation is but slight, the lowest side of the tumbling shaft may be raised by putting a liner under the bearing. If the arms should need any setting, this should be done before altering the length of the reach rod, as these alterations would conflict with each other. After the links are proved to hang alike, the height may then be adjusted by lengthening or shortening the reach rod, so that they hang according to previous directions.

The next thing in order will be to set the eccentrics, which may be done by commencing with the right hand side of the engine.

Place the crank on the forward center, then examine the marks on the straps, in order to see which is the forward and the back motion; as some builders put the forward motion eccentric, next to the box, and *vice versa*, hence the necessity for this precaution. Practically, it is better to put the back motion next to the box, because the forward motion is then easier to get at, which is a great advantage, particularly when an eccentric slips while on the road, and the forward motion is the most important. We have often heard engineers curse the man who puts the forward motion next to the box. If the back motion is to be placed next to the box, move the eccentric up to within $\frac{1}{4}$ in. of the box, and roll it around so that the belly, or throw, comes directly under the axle, as in Fig. 2, where A represents the back motion. Then move the forward motion up to within $\frac{1}{4}$ in. of the back, and roll it so that the throw comes directly over the axle, as represented by B, this may be determined by the eye as it is only a preliminary operation. It is advisable to leave $\frac{1}{4}$ in. clearance between the eccentrics and box, so that they may not strike it and be loosened, and equally as necessary to have $\frac{1}{4}$ in. between them to prevent the straps from interfering. The eccentric rods may now be put on and the ends connected to the links. Of course the same directions will apply to both sides of the engine; and we also state that the eccentric in use always follows the crank when a rock arm is used, as it reverses the motion, and any alteration in the length of the rods must be made in the opposite direction from which it appears on the valve stem, in squaring the valves for the same reason. After putting on the rods it is necessary to look in the steam chest, to see if the valve stands in the center of the seat, or nearly so, which will be seen at a glance; also throw the lever forward and back, so as to try both motions. This precaution is very necessary as the rods may be extremely long, or short, so that when the engine is moved the valve will strike the end of the chest or the link block; the top or bottom of links, and either strain or break some of the parts. We have seen this occur where the man in charge neglected this precaution.

If this examination is satisfactory the next step will be to take the dead centers. The main rods being connected we now move the engine ahead so that the crank on the right side stands about $\frac{1}{8}$ in. from the end of the forward stroke, see Fig. 3, and make a center punch mark on the wheel cover at A. Care will be taken to place this point so that the marks made on the tire with the tram will be about 6 in. ahead of a line, G, passing through the center of the axle. The tram should be held level. This tram, B, is made of steel with sharp points, and usually measuring 14 in. With this tram from the point A, describe an arc, H, on the tire, then make a fine center-punch mark on the forward guide block, and with the short tram F from this point, describe a short arc on the crosshead. Now move the engine ahead until the crank passes below the center, and the arc has also passed the tram about $\frac{1}{4}$ in., we of course hold the tram F in the same position, and now move the engine back carefully until the point of the tram and the arc on the crosshead correspond. It will be observed that both these points are taken with the crosshead moving towards the end of the stroke to obviate any difficulty which may arise from lost motion in the connections of the main rod.

With the tram B describe the arc I on the tire, and with another tram from the center of the axle, describe an arc cutting the arcs H and I, at about the center of the tire, and with a pair of dividers find the center E between these two points. This will be the dead center required. Describe a small circle about this point to assist in finding its locality. These directions must now be followed to find the three remaining centers, after which we will proceed to square the valves or equalize the travel, which is done in the following manner: Throw the lever in the forward motion, commencing on the right side of the engine, move the engine ahead, holding the tram B in position until the point E on the wheel, and the point of the tram correspond with each other; this will be the front dead center. Then, with the tram F, Fig. 1, from the point C, describe an arc on the valve stem, with the longest part of it below the line, as shown in the figure. The object of this is to distinguish the forward motion from the back, observing to let the forward motion extend below, and the back motion above the parallel line. This point being taken, we proceed likewise with the other three points, marking them in the same manner.

After finishing the four points in the forward, we proceed to take the same for the back motion, in this manner: Throw the lever in the back, motion, and move the engine ahead until the center point on the wheel has passed the point of the tram B about 6 in., then move back carefully until the point fits the tram and mark the valve stem, as in the forward motion, only the longest part of the arc above the parallel line, (see cut), and so in their order, take the four centers in the back motion. Having taken all the eight points we now examine the lines to see if the valves are square. With a pair of dividers from the point B take the distance to the nearest point, forward motion, and then place the point of the dividers in the point E, and see if the distance is the same to the nearest line for same motion. If it is, the valve is square, but if not, the difference must be divided, and if the valve travels too far ahead, the eccentric rod must be lengthened one-half the amount of this difference, and *vice versa*. In this manner go over the other points and mark the amount necessary to alter the rods upon them, with a piece of chalk. After adjusting the rods it will be necessary to go over the same points again, and in the same manner, and so on, until the valves travel equally between the lines B and E. Always observing to rub out all, except the permanent marks on the valve stems, before going over the points, to avoid confusion. The valves are now squared, and the next step is to give them the required lead, which is understood to be the amount that the valve must stand open when the crank is on the dead center. Some master mechanics proportion the amount of lead, so that when the lever is placed in the center notch the valve will have $\frac{5}{16}$ in. lead, which we believe to be a very good plan, for no definite rule can be adopted, as the rods of different engines are of different lengths, and the shorter the rod, the faster the lead will increase. In the case before us we will say $\frac{1}{16}$ in. lead is required at full stroke. On the points B and E, with the dividers, set off $\frac{1}{16}$ in. outside these points, by describing short arcs shown in the cut. Commencing with the right side, place the crank on the forward center with the lever in the forward motion. Slack the set screws in the forward motion eccentric, and roll it towards the crank indicated by the dotted line in Fig. 2, until the point of the tram F, Fig. 1, fits the small lead arc just outside the point B, and tighten the set screws in the eccentric. Now, without moving the engine, throw the lever in the back motion, slack the back motion eccentric, and roll it towards the crank until the same lead arc outside the point B corresponds with the point of the tram F, as for the forward motion. Then tighten the set screws in eccentric.

The engine should be moved over these points to see that they are not affected by lost motion, and very likely the forward motion will have to be re-adjusted, owing to the fact that rolling one eccentric throws the other out.

In the same manner set the left side and prove it. The valves are now square and have the required lead, but we must ascertain if they will cut off square in each of the notches; therefore, we place a square on the guide, and draw a short mark corresponding to the end of the crosshead when the crank is on the center, which is called the traveled point. Throw the lever in the 10 in. notch, that being used more than the others generally, and hold the tram F in position, moving the engine ahead until the point accurately fits into the point B. Great care must be taken in testing these points as the crosshead may move some distance without showing much on the valve stem. Measure from the front travel, point to the edge

Fig. 1

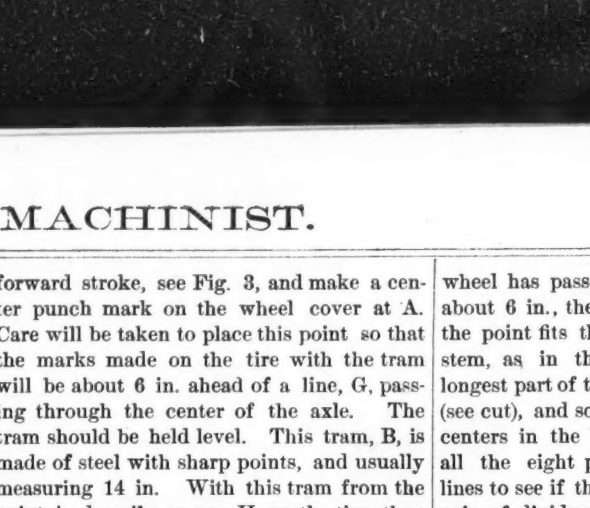


Fig. 2

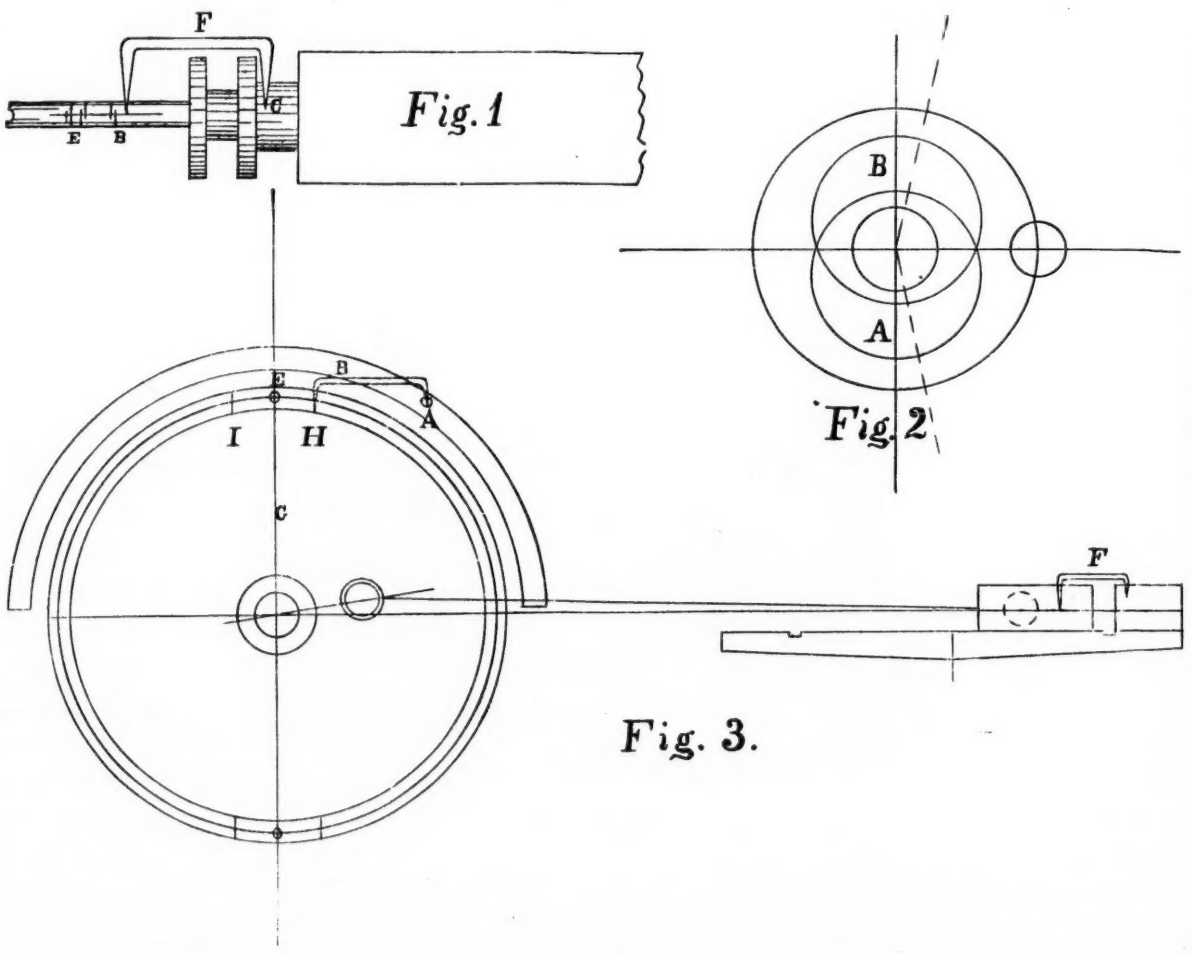


Fig. 3.

of crosshead, and mark it on the cylinder, or steam chest near the front end, so as to remember it, and in the same manner test all the other points in the forward motion, marking them in the same manner. If, after taking all the points we find that they agree, the valves are right.

But it may happen, and does, generally, that there will be a variation caused by the links being worn, etc. For example, we find on the right side that the crosshead will travel 10¼ in. from the front travel-point, and only 10 in. from the back. We here find that the cut-off takes place too quick on the back end ; therefore, to equalize this, we are obliged to shorten the eccentric rods a trifle to cut off square. This, of course, throws the valves out of square in the full stroke notch, but practically, it is found to be the best way to remedy this evil. We may shorten the back motion the most, as it is of the least consequence. On new work, the cut-off is adjusted by moving the saddle on the link, until the valves cut off square, but cannot be done on repairs.

To lay out the notches in a new quadrant it is only necessary to clamp the lever in position. For the forward motion give the link ½ in. clearance between the block and the top of slot, and ⅜ in. clearance between the bottom of block and bottom of slot. These measurements are to be taken when the eccentric is at the extreme throw. For the other notches move the crosshead so that it stands at the position where you wish to cut off, and move the lever until the valve cuts off, which may be determined by the tram in the points B and E. After clamping the lever fast, move the engine so as to test both sides, as in directions for cutting off. After the cut-off is adjusted, nothing now remains to be done but to fit and drive the keys in the eccentrics, and before moving the eccentrics they must be marked by a two-edged chisel, in order to replace them as they were before.

These marks must correspond on the axle and eccentric, and be made with great accuracy. We now examine the motion thoroughly to see that the parts are all secure; and some master mechanics put a piece of tin in all the eccentric rods after the foregoing operations, to allow for the expansion when the engine is hot. We have always found it advisable to set the valves when the engine is hot, or, if they were set when cold, to run over the points just before the engine leaves the shop.

This completes the operation of setting the valves. The construction of the different parts may be found in a very nice little work in our possession, entitled, "The Catechism of the Locomotive," by Forney, and in the most practical way. The writer has frequently performed the operation of setting the valves, and equalizing the cut-off in from 3 to 5 hours, minus fitting the keys. We hope that these instructions will enlighten that class of machinists who have heretofore considered the work of setting valves as among the shop secrets.

The Deane Pump.

The accompanying cut represents an 18x8x18 Fire Pump of the Deane pattern, made by the Holyoke Machine Co.

The Deane Pump has been long and favorably known, and several thousand of them are in use in all kinds of pumping service, and wherever used they have maintained the reputation of being thoroughly reliable. This fact is owing principally to the use of plain slide valves in the steam chest, dispensing entirely with the use of bolts, screws, nuts, springs, levers, cams and other mechanical complications so common to the ordinary direct acting steam pump.

The steam valves in all sizes are jacketed, and have a straight mechanical connection with the main piston, and do not depend on a cylindrical valve to operate them. This construction insures the leading of the piston by the valve under all circumstances. The water end of the fire pumps are made from new and special patterns. They have larger proportion of water areas than any other pump made. The water valves are arranged in the larger sizes with those for suction on one side of the cylinder; and those for discharge on the other, and in the smaller sizes with the former below, and the latter above the cylinder; thus, by shortening the passages, and reducing the number of turns in the pump, insuring the minimum of friction and not dissipating the power of the engine in forcing water through a labyrinth of cast iron.

All pumps made by this company are tested under steam and water pressure prior to leaving the shop, and are fully guaranteed by the manufacturers. The New York office is Deane Steam Pump Works, 85 Liberty street.

The Deane Pump.

Marine Boiler Tests.

Cincinnati, Oct. 28th, 1878.

Editors American Machinist.

Gentlemen.—I have a word or two to say in regard to "Marine Boiler Explosions."

It would seem that when a passenger trusts his life on board a steam vessel he ought to be protected as far as human care, and the "Marine Laws" can and have power to do.

The U. S. Law, *theoretically only*, professes to have all boilers tested, to a certain point above the ordinary working steam pressure, with cold water. Then again, *theoretically*, the interior and exterior of all boilers are to be examined, as well as all fittings and connections, so that any defect may be discovered.

First.—There may be defects of a very serious nature which will not, and cannot, be discovered by a cold water test, unless a leak occur at the time the pressure is applied. It would appear that the United States law is defective in regard to this rule, as it calls for a test, two-thirds of which is allowed for a working pressure. A few years ago a sum of money (one hundred thousand dollars) was appropriated by the Govenment to make experiments with a view of discovering the causes of boiler explosions; boilers were tried under various circumstances to see if they would give way. One experiment was of this nature: a marine boiler was tested by cold water to a pressure of 150 lbs. per square inch; though by law 100 lbs. would have been considered a safe working pressure. After examination to see if all was right the examination was made in this case internally and externally, and all was found right: the boiler was then filled, a fire lighted, the experimenters retired to their boom-proof retreat, and steam was raised to ascertain at what pressure the boiler would rupture. At 85 lbs. the Steam chest or Dome ruptured. This would appear to prove the danger of continuing the practice of testing in this way, as the boiler gave way at 15 lbs. under what an inspector would have been authorized to allow.

Secondly.—There are numbers of Steamboats leaving this place daily for various places, and ferry boats plying across the river, loaded with human beings, the boilers of all of which are tested as above, and have U. S. certificates allowing 125 lbs., 140 lbs., and 150 lbs. of steam "and no more" Providence help the passengers! These boilers are of the following dimensions mostly: 24 to 30 feet long, 36 to 48 inches diameter, having two flues 16 inches diameter, and some 4 or 5 flues, 8 inches and 10 inches diameter.

An eminent engineer, Sir Wm. Fairburn, now dead, made a number of experiments, in consequence of the large number of boilers giving way from collapsed flues, to ascertain the cause; he found three things. First—The flue was weaker than the shell. Second—The larger the flue the weaker it was. Third—The larger the diameter and thinner the metal of which it was composed the weaker it was. By the rule he adopted, and which has since been used by engineers all over the world, a boiler having flues 16 inches diameter and 24 feet long, made of $\frac{5}{16}$ in. metal, and not provided with any stays, would collapse at or about 200 lbs. pressure; according to mechanical laws, one-sixth; and in English practice one-fifth would be considered a safe continual working pressure, which would be 40 lbs. (one-fifth); but hundreds of boilers on the passenger boats with such flues so constructed have certificates allowing them to carry a pressure of 140 lbs., "and no more."

As the continual margin between what a boiler will blow up at and what it carries is only about 60 lbs. per square inch, it appears to me that it is only a matter of time before we shall hear of many more "Brilliant" (the name of a boat which exploded above here), "Westfield," and "Adelphi," disasters.

I am, yours truly,

A. R. Payne.

Cleaning and Dressing Castings.*

The casting in foundries is generally performed in the afternoon, so as to make it the last business of the day. This time is chiefly selected to escape the heat of the hot sand after casting, which will then cool during the night. After casting, the castings are removed, and the moulding boxes piled in a corner of the building, so as to be handy for the next day's work; water is sprinkled over the sand, it is then shoveled over, mixed, and thrown in heaps, where it remains during the night. If the latter work has been properly performed, the sand will be of a proper and uniform dampness the next morning. Each moulder takes charge of his own sand, and but little practice is required to learn the proper amount of water to be used in dampening the sand.

When the metal of a cast is so far cooled as to be strong enough to bear removal, the moulds are taken apart, and the sand or loam is removed from the casting. Small castings require but a few minutes to cool, while heavier casts take hours and even days. A massive casting, such as a forge-hammer of five tons weight, will take twenty-four hours cooling in a green, and forty-eight hours in a dry, mould. The excrescences, fins, spurs, and all ragged edges which may happen to have been formed in the parting or corejoints are broken off as soon as the cast is removed from the mould. The gates are, at the same time, broken off by the moulder; it requires some degree of skill to break a gate off smooth. Heavy castings are chained to a crane and hoisted by it. Very heavy castings require the united strength of two and more cranes. Small castings are removed from their moulds by tongs; one, two, or more presons taking hold of a casting at the same time, carry it to a place termed the fettling shop designed for the reception of hot castings. Projections which cannot be removed in the foundry, are chiselled and chipped off in the yard, or in the fettling shop where the casting is roughly prepared for further work. Heavy cores and particularly hard cores, are removed in the foundry before the casting is entirely cold.

The cleansing of castings is a simple operation in an iron foundry where common castings are made; any workman is fit to trim a coarse casting, or scour it. The first is done by means of chisels or sharp hammers; the latter with dull, coarse files, which have been usedand rejected by machinists. Cast-iron files are also used for the latter purpose. The trimming and cleaning of valuable castings, such as statues or ornaments of art, is not so easily performed. An unskillful workman can easily spoil a whole casting in unskillfully chipping or trimming it. This kind of work is therefore generally entrusted to skilled workmen, and on such articles as statues the artist himself generally works out the details of the more important points.

Grindstones are largely used in fettling, the stones being a variety of sandstone commonly obtained from coal districts. They should be of a hard, close-grained, sharp quality, free from veins and uniform in color. The stones are generally driven by steampower, and when, as is frequently the case, they run at a high velocity, they are very dangerous, from their liability to crack asunder. To decrease this danger as much as possible it is usual to apply rings or plates of iron to the sides of the stones; these are bolted on some soft substance, such as felt, being placed between the heads of the bolts and the stones. Dry grinding cuts slowly, and creates considerable dust,

*From a Practical Treatise on Casting & Founding By N. E. Spretson, Engineer. E. & F. N. Spon, London, and 446 Broome St, New York.

but leaves a smooth skin. Wet grinding cuts quickly, and prevents the grain of the stone from becoming choked with particles of metal.

Neither files nor grindstones fettle so well as emery wheels, which are formed of emery of requisite coarseness, mixed with a cementing material.

The cementing material employed in Ransome's emery wheels is an insoluble silicate, a substance of hardness approaching to flint; and which, by a curious chemical process, is formed within the substance of the block or wheel, there being no means of effecting its direct use.

This cementing material is so strong, that if a block of emery composition made with it be broken, it will be found to have fractured through the grains of emery, and not by pulling them out of their matrix. It is so hard as to cut well in itself, and yet sufficiently softer than emery to wear away faster, and thus avoid the glazing otherwise inevitable. The cement, being insoluble in water, enables blocks prepared with it to be used either wet or dry, although the latter way is in most cases preferable.

Small blocks of consolidated emery may be used with great advantage by hand; but of course the proper result is obtained when the form of a circular disc is adopted, and the same rotated at a high speed. Under these ond itions the durability and cutting powers of the material are extraordinary, experience having proved that minutes with the wheel will do the work of hours with the file or chisel. A revolving wheel cannot go into corners, or do every variety of work, but an immense deal may be done, and the saving of both time and tools is very great.

Ransome's emery wheels are much esteemed in English foundries, and from the circular of the makers, A. and H. Bateman and Co., of Greenwich, we give the following practical remarks, which apply generally to emerv wheels, on their use :—

"It is well to run a coarse and fine wheel at opposite ends of the same spindle, doing the rough work on the former and finishing up on the latter. Far more work can be got out of the wheels by applying the work lightly to them, than by pressing or crowding it; the latter only heats the metal, makes the wheel glaze, and often go out of truth.

"Speed has a great deal to do with result; from considerable experience, a surface speed of 4000 to 4500 feet per minute, say 1350 revolutions of the spindle for a 12-inch wheel, is recommended, although a thick wheel may be run one-third faster with advantage, and good work may be got out of a slower speed.

"A foundation for the machine, good enough for slow speeds, will not do for high ones. Any vibration or tremor while at work is certain to produce bad results. It is not enough to screw a spindle firmly to a bench or table, the latter must itself be firm and rigid. In self-contained machines, a good concrete foundation is necessary; the expense will not be grudged, when the results are compared with those obtained from a machine on a shaky foundation. It must be remembered, that a large amount of centrifugal force is developed in a disc revolving many hundred times in a minute, and this must be met by firm foundation, and proper screwing up of the washers and side plates. Too much care cannot be taken on these points."

To A. and H. Bateman and Co. are also due the subjoined practical suggestions:—

"1. Examine emery wheels and machines at least once a day.

"2. Remedy any defects at once, and on no account go on working with anything out of order. If a machine vibrates, add or alter requisite fittings. If a wheel is chipped or out of truth, true it with a black diamond. This may be done while running at full speed, care being taken to touch the wheel *very lightly*. After trueing, the wheel will be dull; rough it by running it against a piece of copper, or a piece of hard coke. Do this frequently; it makes work pleasanter, and wastes the wheel far less than waiting until it is very much 'out.'

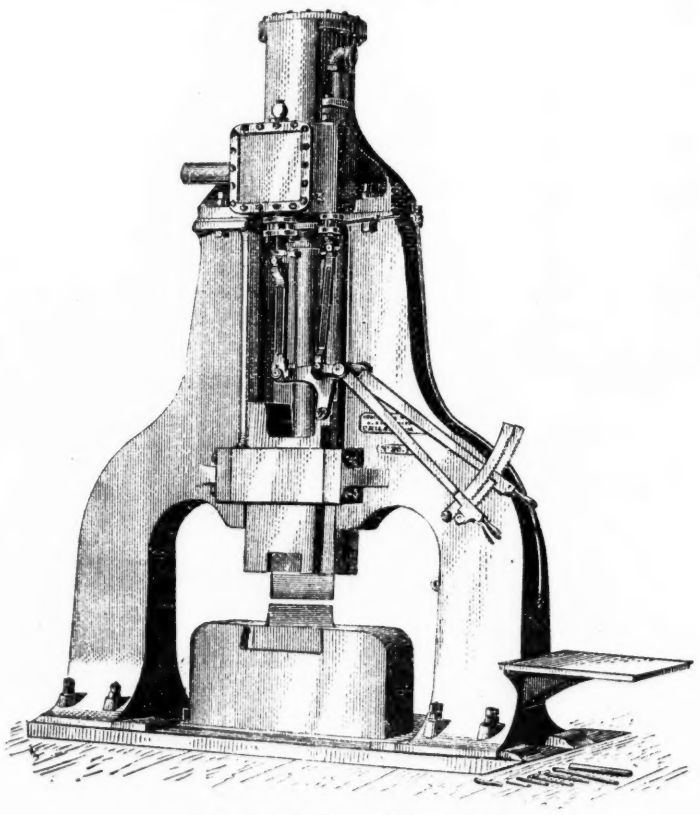
"3. Never let the spindle jump or get hot, either will injure the wheel and produce bad work.

"4. See that side plates fit the spindle, and are fairly true. Screw up firmly, but not so tight as to crush the wheel. Do not use too long a spanner, it is difficult to estimate the force applied by means of a screw and long lever.

"5. Be careful to run the wheels at about the indicated speed; they wear out quicker if run much slower, and are apt to go out of truth, and an unnecessary risk is run if the speed be too great. Ascertain the speed by means of a counter. Calculation by size if pulley is not very reliable, owing to the difficulty of making proper allowance for 'slip.'

"6. If working with water, let it be applied close to the work, through a small orifice in a pipe under some pressure, either from the main, or from an elevated cistern. The wind caused by the wheel will otherwise tend to blow the water away. If too much is used it will fly off and cause inconvenience. Generally, working dry will be found preferable, but for tools and small work water is necessary.

"7. With tools and small work, hold in the right hand and press near the end with some of the fingers of the left hand. The moment the heat becomes uncomfortable dip the work in water standing by, and then replace it on the wheel dripping, it not being necessary to dry it. Heat that will not hurt the fingers will not injure the temper of the steel.



BEMENT'S STEAM HAMMER.

"8. If a wheel breaks, nearly if not all the fragments will fly in the line of rotation. In grinding, therefore, stand as clear as possible of this line, to avoid injury in case of accident. Railway trains sometimes come to grief. An emery wheel running the same speed may do the same, but will not with proper care.

"9. Mount the wheels with the washers supplied, and do not strip them off and put on others.

"10. Most important of all, remember that *fair working gives best work*. Forcing work against a wheel injures both, causes risk of accident, hastens the wear of the wheel, frequently causes glazing, which never happens with proper grinding, and is sure to wear a wheel untrue and involve very frequent trueing up."

There is but one limit to the use of emery wheels for fettling castings, and that is the size and weight of the casting. All castings, whether iron or brass, not too heavy or unshapely to be readily handled, should be fettled by the solid emery wheels, and it is placed beyond dispute by the experience of years, that this plan is cheaper and more practical than any other.

We see little reason to doubt that the solid wheel will in time entirely displace the grind stone. There is really no advantage in the very large size of grindstones, and the great variation between their maximum and minimum size causes much inconvenience to the workman. The size of emery wheels is such that they occupy but little space, and are mounted with the greatest ease and speed. They are so strong that they can be run at an immense speed, and being composed of angular grains of a mineral only inferior in hardness to a diamond, they cut much more rapidly than grindstones, whose uneven texture is mainly caused by round and waterworn particles of silica. While the stones have to be roughed and picked from time to time, no really good emery wheel ever requires such treatment, presenting always a fresh, free, sharp-cutting surface. In consequence of the hardness of the surface and the very high speed, the work needs to be lightly touched to the wheel, and the selection of heavy men as grinders is done away with, as are also the swinging boards, housings, and appliances for getting pressure. Owing to the moderate size of the wheels, they can be easily turned with diamond tools, and thus always revolve as perfect circles instead of becoming eccentric as the stones do.

Bement's Steam Hammer.

The steam hammer is a very important tool for large machine shops, and its construction has exercised some of the highest mechanical skill in our own as well as in foreign countries. Subjected as it is to such severe strains, a steam hammer needs to be built extra strong, and with its working parts as simple as possible. The one here taken as an example has met with great success for many years.

Herewith is illustrated the 3,000 lbs. steam hammer, manufactured by W. B. Bement & Son, Philadelphia. The weight of drop and attached parts is about 3,000 lbs., varying somewhat with length of stroke and kind of dies; largest size of die face, 11½ in. x 20 in.; usual stroke for iron work 36 in., shorter for steel drawing; double-acting, taking steam both above and below piston; perfectly balanced slide valve, working with accuracy, but very easily and almost without wear; valve-gear is very simple and substantial, producing every variation in length, position, rapidity and force of blow, whether operated automatically or by hand; piston rod and rings of cast steel, piston and drop of wrought iron; piston can be raised above top of cylinder for insertion of packing rings without separating rod from drop; every hammer tried before leaving the works.

These steam hammers are made in the following weights, 350 lbs., 650 lbs., 1,100 lbs., 1,750 lbs., 2,150 lbs., 3,000 lbs., 4,000 lbs., 6,000 lbs., and 12,000 lbs. The capacity of the Industrial Works of W. B. Bement & Son is enormous, comprising a most extensive variety of tools.

The New York salesroom is at 121 Chambers and 103 Reade streets. Mr. George Place, agent.

Upright Drill.

The accompanying cut represents a drilling machine, recently put on the market by The Pratt & Whitney Co., of Hartford, Conn., to meet the demand for a low-priced machine, capable of doing, well and quickly, a large amount of work. The spindle is of steel, 1⅝ inches diameter, counterbalanced, has vertical movement by hand lever of 3 inches, overreach of eleven inches, and can be quickly adjusted to any desired height within its range of 16 inches. The drilling table is 20 diameter, has vertical adjustment by means of worm-gear, pinion and rack of 24 inches, may be swung to either side of the column, and will receive work 32 inches in height.

The base table is planed to a right-angle to the spindle and will receive work 46 inches in height.

The driving pulleys are 11 inches diameter for 3 inch belt; largest diameter of cone pulley, 10 inches for 3 inch belt; weight, 950 lbs.

This machine is furnished with hand-wheel, for feed and quick return, when preferred to the hand lever.

A smaller machine of similar construction, is also built by the Pratt & Whitney Co. with drilling table 14 inches diameter, and weight of 700 lbs.

Extracts from Chordal's Letters.

MESSRS. EDITORS :—Mrs. Toodles still lives among us. She runs a machine shop now, in fact she runs a great many shops. Her address is on the books of every receiver, assignee, trustee and firm bankrupt in the country.

They send her lists of tools and general shop plunder, to be sold on such and such a day. She goes and looks around and reasons in this style: "What do I want with that bolt cutter? That's a *good* bolt cutter, the dies are all there, and in good shape. I came to buy a bolt cutter, but don't want such a one as that. And that lathe—I don't see anything the matter with *that*. If the bed aint sprung I don't want it. If it is modern I don't want it. If the change gears are all there I don't want it. If no teeth are broken out of gears or racks, I don't want it. If it has proper belt power, I don't want it. Don't care if it is only two years old, I don't want it. Fitchburg lathe is it? Thirty-inch swing, twelve-foot bed. So you bought it, did you, for $400? Well, I don't want that lathe. Now I will bid. Wouldn't give a dollar for

it, hey? Why, I run this big lathe forty years ago, when I was a girl. I know it's a good lathe, and its better than it was then, for it's been blocked up twice. You take your Fitchburg lathe, this one suits me. Now, you see, I've got it—only $300. What's that going now? Babbitt metal? Let's see, I don't want that, that ain't old metal. There's a lot of twist drills, four old drills and forty old shanks—I want them and that vice."

What nonsense. It is the experience of machine auctioneers that old worthless plunder brings half the market price, while it is difficult to get bids on things of real value. Mrs. Toodle's auction bill would buy a sensible person one good lathe, instead of two good-for-nothing ones. Her twist drills cost her exactly twice the list price, and when she gets home she will find they don't fit her drill sockets; she will alter the sockets, and then her other drills won't fit. The plan of breaking a twist drill in two and calling it two twist drills suits her. Speaking of the shanks of drills, leads me to throw out a hint to the twist drill makers. My own experience with the universal taper shank is that something is wrong. They will not answer, and the most carefully managed shops in the country are finding it out. The taper is very expensive, easily marred, and it is almost impossible to secure interchangeable fits. Even the twist drill makers do not succeed in doing it. The taper will not prevent a drill from dropping if it takes a bite as it finishes a hole, and most drills do this, unless the workman expertly reverses his feed when the drill point starts through.

All drilling machines have a little lost motion, and, as it comes through a job, a twist drill will take advantage of this lost motion, and, quick as thought, will drop, catch, and tear the job loose from its moorings, or else pull slightly out of its socket and stand still. In the latter case, the *upper* end of the drill becomes the cutter, and it immediately proceeds to bore the driveway out of the socket. The only recourse is to stop everything, lift the spindle, and in many cases move the job and force the drill tightly into the socket again. But it is too late to prevent damage, for one revolution of the socket over the drill will ruin one or the other. The thing is contagious also, for one of these injured drills will at once ruin any good socket into which it may be placed, and one of the damaged sockets will ruin any good drill which may be put into it. When this disease once attacks a twist drill it becomes epidemic in the shop, and spreads instantly to every socket and drill of that sized shank. There is not a large concern in the country which cannot show a barrel full of expensive sockets and drills ruined in that manner.

When a drill gets its driving tenon "chawed" off it is a possible thing to turn the drill shank up again, and make it practically as good as new. This process of repair will never cost more than two new drills would.

But when it comes to the female member of the family it is much different. No skill or expense can renew one of these sockets. If we put a big socket in the drill spindle, a small socket in the big one, and so on, for two or three steps, till we have built down a hole which will fit the drill in hand, we have a nice state of things. Some one thing in the complex system is bound to be a bad fit, internal dissensions commence as soon as the drill sees the other side of its job, and then some one or more of this interesting family of tapers will begin its ruinous operation of destroying its own or its neighbor's usefulness.

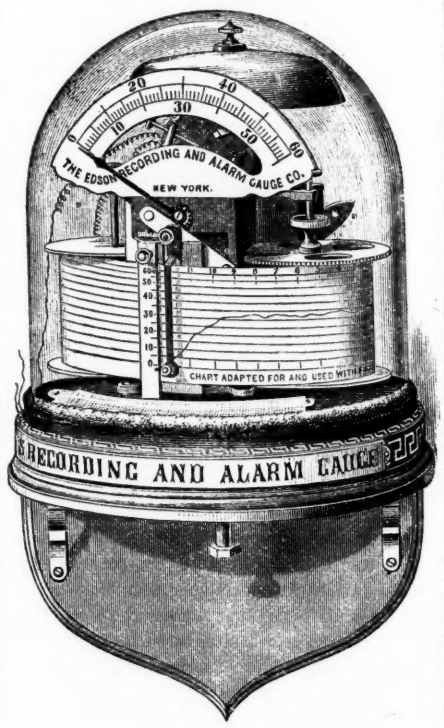
Machine tool builders follow the same plan and get up their drill spindles like large sockets.

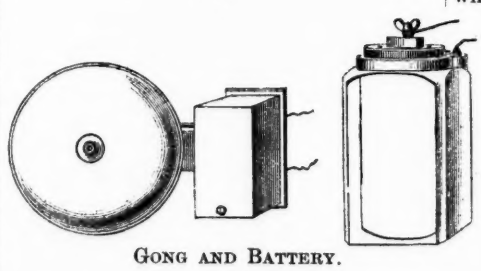
The taper, as an easy starting, self-tightening device, possesses inestimable advantages in some places, and it was thought that it would be just the thing for drill shanks, which required these same qualities, but fifteen years' experience by the trade has brought with it a disappointed cry for relief.

I, for one, believe that as bad as a set screw looks recourse must be had to it, and that the drill sockets for the future will have standard sized parallel holes. The set screws will probably be headless and have a square hole for a plug wrench. This will dispense with that murderous projection usual with set screwed sockets.

The parallel arrangement of holes will allow them to be gotten up in hardened steel, which will certainly add to their truthful durability. The drill shank, in such case, will be turned or ground a *driving fit*, flattened severely on one side for the set screw, and cleared or relieved on the half-circumference on which is the flat place. This will allow shanks to enter the sockets easily and *still retain every advantage of a driving fit.* It is sometimes very convenient to be able to lower a drill in the socket. This can be done with the arrangement as described, but cannot be done with the taper shanks.

I know of one concern which has laid aside thirty taper hole sockets, all ruined, and made thirty on the parallel plan mentioned. They make their twist drills, &c., to suit, all on the relieved plan described. They are found to be perfectly satisfactory, run dead true, don't get damaged, and are far cheaper





GONG AND BATTERY.

than the tapers. I was shown a drill thirty inches long, thus fitted, which ran dead true at the point. It would not have done so with the taper shank, even with everything new. The concern spoken of has nine drill presses, and all had the spindle holes bored tapering. They would not re-bore to their standard parallel sizes, so they were not re-bored at all, but parallel sockets were permanently secured in all the spindles by a through pin.

The Putnam Machine Company of Fitchburg, at one time got up their drill press spindles as usual, with taper hole and driving mortice, but they afterward adopted a new plan. They omitted the mortice and cut a keyway in one side of the taper hole. Each socket would have a feather of some length let into its shank solidly. This feather, fitting the keyway in the spindle hole, did the driving. I never got to watch one for any length of time, and cannot say how well it answered. I should judge, however, that the arrangement was open to every objection which applies to the usual plan, while it certainly must be more expensive and less reliable for truth.

I would do the parallel shank great injustice if I failed to call attention to the fact that it don't have to be driven into the socket and that it don't have to be drifted out. The "Kit" required to do five minutes' drilling is thus materially reduced. When drills are drifted out of their sockets, they often gravitate toward the floor, and striking the base plate of the machines are more or less damaged. I believe one-third the breakage of drills and drill chucks is due to the falls they get when being drifted from the sockets.

The twist drill question is certainly worth overhauling, and I hope that at an early day the twist drill men will put into the market drills with relieved parallel shanks of standard size, classed of course as the taper shanks now are, four sizes of sockets, I believe, being required for a set of drills. No such other labor and money-saving tool as the twist drill has been offered to the machine trade in modern days, and its importance suggests that the two ends should be gotten up on equally efficient plans.

While worrying about drills, I wish to ask if an invention is not called for in the way of a good substantial *adjustable* chuck-drill, if such qualities may possibly be combined. Chuck drills are generally made of feat steel or old files, and thus far nothing has been gotten up which will equal them in their peculiar capabilities.

Among agricultural implement makers it is the main tool. Their expert boring hands put these ugly looking drills through one-sided rough cored holes dead true, a hand reamer finishing the job.

I have noticed one queer thing about chuck drilling. In the agricultural shops, where the work is all rough, a green boy will be set to work at a chucking lathe, instructed a short time in this work, learns nothing else, and soon bores good true holes without any appeal to luck. He never even finds out that his drills have a tendency to travel and run out. On the other hand the fine lathesman, working on nice work often uses these drills to follow cored holes or to cut from the solid, but he never even by chance succeeds in getting one to go straight through. He never seems to get the "swing" of the process. He never acknowledges this however, and attempts to console himself by saying he only wanted to take the sand out and didn't care whether it ran true or not. It will always be found that such men set such a drill at work with good resolutions to have it go through truly, but the affair ends in good resolutions, and the drill soon goes on its winding way as usual * * *

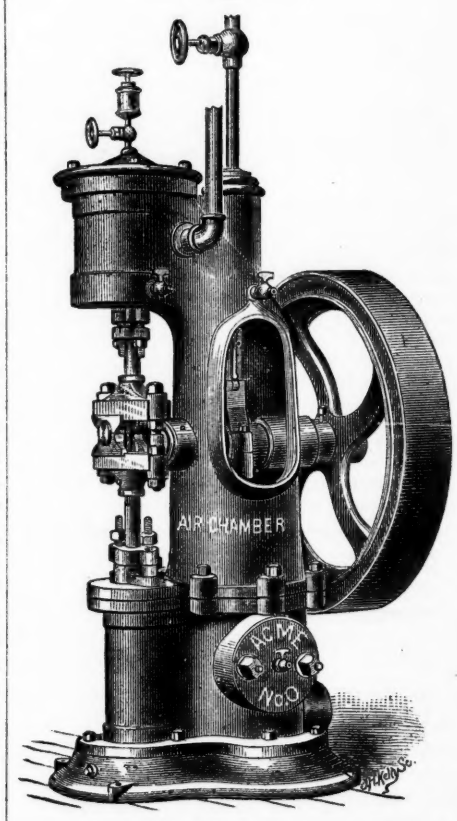
Very respectfully, CHORDAL.

The Edson Recording Gauge.

As a means of preventing explosions of boliers, both marine and stationary, the Edson Time and Pressure Recording Steam Gauge, illustrated herewith, has proved itself one of the most efficient. It has been thoroughly tested during the past six years and, according to the best information we can obtain, there has been no instance of a boiler explosion where this gauge has been attached. This instrument affords a perpetual record of the pressure of steam indicated on a dial as easily understood as on the face of a clock. Attached to the recording steam gauge, and forming a portion of it, is an alarm bell which rings out a warning signal when the pressure of steam has reached the appointed limit. A pencil marks on paper automatically a continuous record of the pressure of steam carried and besides, by the action of electricity, rings an alarm bell in the engine room when the limit of danger is reached. It may be placed at any distance away or close to the boiler itself. These safe-guards act as an admonition to the engineer in charge to be faithful in the discharge of his duties. The two small cuts represent the vibrating gong and a battery which communicates, by means of a two-inch wire insulator cable, with the circuit closer upon the recording gauge and rings the gong continually while danger impends.

On steam vessels this instrument has shown itself a very valuable safe-guard. If we accept the statement of the Supervising Inspector General of Steamboats, which appears in his annual report, viz.: "Explosions, in all cases, are the result of ignorance, inattention and recklessness," the paramount necessity of employing either a recording and alarm gauge, or something else that will give as reliable notice of approaching danger is plain enough to any engineer. The recording gauge is in regular use by many ocean steamship lines, the White Star, Inman, American, etc., also by leading Sound and river lines of steamboats. It has met with substantial appreciation abroad as well as at home.

Many of the ships of the English, Austrian, and Russian navies have adopted it, and others will probably accept it with their next improvements. On land, as well as on water, its use is becoming well established. Many extensive manufacturing concerns throughout our country find that it effects a saving of fuel by regulating the steam pressure, thereby diminishing injurious strain upon the boiler, by furnishing a check upon any negligence or ignorance of the engineer and a safe-guard against disastrous explosions. The manufacturers are the Edson Recording & Alarm Gauge Co., 91 Liberty St., New York,



The "Acme" Double Acting Steam Pump.

The Steam Pump above illustrated is built by the Valley Machine Co., at Easthampton, Mass., who are also the manufacturers of the celebrated Bucket-Plunger Steam Pumps. The object the builders had in view in bringing out this new Steam Pump was to meet a want for a *good* low priced machine; and that they have accomplished this result the numerous orders and testimonials they are constantly receiving goes to prove. This pump is thoroughly double-acting on both suction and discharge, all the parts are easy of access, and all well made from the best material for the purpose used.

The steam valve is the plain three-ported D valve moved by an eccentric on the crank shaft, the steam chest being a cylinder cast in the bend of the frame, thus making the latter perfectly rigid under heavy pressure. The shaft bearings are lined with best Babbitt metal with a simple method of taking up the wear, and the arrangement for oiling the bearings are such that they require but little attention. Every pump is thoroughly tested before leaving the works, and when sold is fully guaranteed. For further particulars send to the manufacturers as above.

The electric light is one of the greatest mechanical studies of the day. It would be difficult to estimate how many hundreds or perhaps thousands of people are now devoting their attention to its development. Prof. Edison has electrified the civilized world with the announcement of what he can accomplish with it, and the gas companies are uneasy over the prospect of diminished receipts and danger to the monopolies they possess. There is no doubt that the electric light is a success, but how general may be its use and how cheap the cost of sustaining it are problems many enterprising inventors are trying to solve.

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NEW YORK, NOV. 15, 1878.

Machine Shop Economy.

In times like the present when even with good management our best machine shops are enabled to exhibit but small margins of profits, and shops with indifferent management exhibit margins on the wrong side, it is a question of paramount importance what kind of economy should be pursued in order to maintain a successful business. The directors of long established machinery enterprises differ widely upon some methods of conducting business, and while one gains success by pursuing a certain plan, another, with perhaps as much ability, can not pursue the same with satisfactory results.

While in the main there are many different plans upon which successful machinery establishments are conducted, there are some underlying principles that must be observed to avoid meeting with difficulties. The rate of wages paid is certainly a large element of shop economy, but there are so many other elements that should be considered before wages are reached, that we often find proprietors, who pay their workmen at a comparatively high rate, doing a more prosperous business than their competitors who have reduced wages to the lowest possible scale. Many machine shop owners, not having mastered the various economies of management, as soon as profits begin to shorten, pounce directly upon the wages paid to their workmen and pare them down so as to make up for the deficiency elsewhere. They don't seem to realize that there are important elements of economical management other than closely watching the wages of labor and the cost of material. It is sometimes necessary to reduce the rate of wages, but what a different effect it has upon the men in different shops! In one shop you scarcely hear a murmur—no angry meetings—no threats of a strike—no growling at the head of the establishment. The intelligent workmen understand the reasons for the reduction without a wordy explanation, and accept it, feeling confident that it has not been unjustly made.

In another shop it causes ill feeling, angry protests, and perhaps a disastrous strike. The owner often charges his trouble to the character of his workmen. Let him review his course, and see if the great cause is not in his own management. Mechanics are keen and observing. If the business is poorly managed they are not slow to mark it, and when a cut is made in wages can generally cipher out the cause. It is good economy to keep a systematic record of the cost of everything. This record will be found very valuable in making estimates—much more so than guess work. It is not good economy to keep using worn out tools when any work of consequence is to be performed. The extra cost of labor and spoiled pieces would soon pay for new tools. It is not good economy to keep discharging capable workmen for petty causes, and employing new hands to take their places. It is poor economy to use slow cutting grindstones to accomplish work that fast cutting emery wheels are suited for. It is questionable economy to employ lathes, planers and drills to perform work of any extent that a milling machine will do better in less time and at much less expense.

It is decidedly bad economy to employ engines and boilers that waste fuel and are troublesome to keep in good running condition. It is mistaken economy to buy inferior tools, machines and shop supplies, because they are low priced.

It is very defective economy to fit the parts of machines together by trial instead of making them by aid of correct drawings and standard tools for accurate measurement. It is faulty economy to practice borrowing and lending working tools. The idea that economy consists in withholding every expense not absolutely demanded is erroneous. An extra outlay in one or another direction often assures the saving as well as the making of money. Wise economy looks to the future as well as the present, and requires that all work sent out from a shop should be of the best and most reliable character.

State Prison Manufactures.

Independent competition in manufacturing all kinds of goods is beneficial to the consumer and to the community at large, but a competition against private enterprise, built up and supported by the government of a State, is not in accordance with the spirit of our free institutions. Until within a few years, the convict labor of State penal institutions was directed in such a course as not to materially interfere with industries carried on by free labor and private capital, but, latterly, prisons are converted into complete workshops, fully equipped with improved labor-saving machinery, steam power, and appliances for producing various classes of goods rapidly and cheaply. The labor of the convicts is then let out to contractors at rates ranging from 30 to 50 cents a day for each able-bodied man, the State furnishing them board, clothing, and snug quarters. The productions of prison labor enrich the contractors, while the prisons are not even self-supporting. The only logical argument that can be brought forward in support of making prisons manufacturing establishments is, that the system earns a large amount for the government which would otherwise have to be raised by taxation. The weakness of this argument is evident when we consider that *not one cent* of the enormous profits piled up by prison manufactories accrues to the State. The ridiculously small stipend for which convicts are hired is all the government obtains, which, as before stated, is not sufficient to pay expenses of keeping them in strong durance.

The most onerous pressure of productive convict labor is upon the free, respectable mechanics, who must needs put forth their labor against that of felons contracted for at less than the cost of keeping them.

The free mechanic, especially one who has a family to maintain, finds it exceedingly hard to compete with the State prison mechanic, whose necessities are all provided for by the government, who costs his employer but a moiety of real wages, and whose labor is aided by the best machinery and processes known to outside artisans. Reductions of wages is the inevitable consequence of such competition, and often extended suffering may result. Few people not directly affected by prison manufactories, realize the importance of this problem. New York has three extensive prisons, each containing hundreds of convicts, and every other of the thirty-seven States has one or more.

A number of manufacturing industries have been started and made to flourish in prisons, and others will doubtless be set going if the system is allowed to continue. Let all these populous prisons be furnished with the most approved shop equipments and conducted as manufacturing establishments and how many now prosperous industries would feel the pinch and be forced to yield to this insurpassable competition? Already, there are branches of manufacture that are almost governed by prison labor, and it is time for thinking men to act in the matter to the end that the convict system of labor may be changed. Some may ask why free skilled labor cannot outreach that of unskilled prisoners? It can do so, but the prisoners who are confined for long terms are apprenticed to the different trades carried on within the walls, and thus become skilled workmen. This is another flagrant evil; the State educates a class of felon mechanics, then turns their skill and manual force against the labor of the masses. It costs something worth considering to learn a mechanical trade, but the convicted felon acquires, under the watchful care of the government, what many a poor youth may not be able to afford. When the thugs are turned loose they are practiced mechanics and well fitted to be expert cracksmen. Is it any wonder that professional burglars display great skill in constructing their tools? Some of the released convicts, being practiced mechanics, seek and obtain situations among respectable workmen, and by exhibiting crooked ways bring the latter along with themselves into disrepute. It is to be regretted that the State should train up artisans from the most vicious classes to disgrace honorable mechanical pursuits. Malefactors are sentenced to "hard labor" but it is questionable whether running labor-saving machinery is as hard kind of labor as was intended for evil doers when the laws were framed. The fact is, the physical wants of prison convicts are better supplied than those of thousands of free mechanics in times of business depression. Instances might be pointed out where crime has been committed by able bodied men purposely and avowedly to secure even the comforts of prison fare. The prison system of labor, pitted against independent labor, actually places a premium upon crime. The abolition of this system is a political, but not a party question. With the legislatures of the several States rests the responsibility of its abolition. The protest of mechanics should be expressed so as to be heeded at the seat of Government.

Testing Boiler Plate.

A convention of the manufacturers of boiler plate throughout the United States was held in Philadelphia on the 13th instant to agree upon some proper method of testing the strength of iron for marine boilers. As the result of their meeting the manufacturers adopted the following resolutions:

Resolved, That, in the judgment of this meeting, plates which show a contraction of area of less than 12 per cent. shall not be used in a steamboat boiler. We therefore recommend that all boiler-plate stamped with a tensile strain of under 45,000 pounds should show a contraction of area of 12 per cent.; 45,000 pounds and under 50,000 pounds should show 15 per cent.; 50,000 pounds and under 55,000, 25 per cent; 55,000 pounds tensile strength and over should show 35 per cent.

Whereas, the question was raised before the meeting of the Board of Supervising Inspectors at a meeting last January, in regard to the form of test-piece that they had adopted; and

Whereas, the Board, in order to meet the views of the manufacturers, adopted two modes of preparing the test-piece, with a view to ascertain which was right; therefore

Resolved, That the thanks of this meeting be extended to the Board for that act of courtesy which has resulted in the fact that there is no practical difference in showing the two modes, and that we respectfully suggest to the Secretary of the Treasury, that test-pieces cut from the plate to be used in steamboat boilers should all be tested at some central location, by a person appointed by the Secretary of the Treasury, to be under the direction of the Supervising Inspector-General of Steamboats.

Many steam users, in view of practices that have been brought to public notice within the past few months, demand explicit assurances when purchasing a new boiler that the tubes are not second-hand. So carefully have second-hand tubes been fixed up and worked into new boilers that hardly any one could tell by appearance that they were not new. Users of boilers can not be too particular about this matter. Aside from the vexation of being "sold" in the purchase of an apparantly new boiler, by discovering a part of it to be second-hand, the possibility of an explosion looms up when a feeling of security would be naturally felt. A little extra caution displayed at first may secure real and desirable safety.

"Our inch is a sixty-fourth smaller than their inch," was the reason we heard expressed the other day by the proprietor of a shop why a job of work made for another shop would not fit. What would be thought of a farmer who should declare that his bushel was a sixty-fourth smaller than his neighbor's bushel, as a reason for discrepancy in a grain measurement; or of a grocer who should gravely maintain that his pound was a sixty-fourth lighter than his customer's pound, when called to account for short weight? Yet there would be no more absurdity in these excuses than in one given by machinists for working by different inch measures. Fortunately there are standard tools, readily procured by machinists, by means of which the smallest appreciable fraction of an inch can be accurately measured. Those who will not use such tools meet with difficulties like the one here mentioned.

We call attention to a communication from Mr. F. B. Allen, M. E., on the "Government Inspection of Boilers," which appears on the next page, also to another communication from A. R. Payne, of Cincinnati, on page 5, upon the same subject. The data given by Mr. Allen will exhibit more pointedly than a theoretical discussion how much reliance is to be placed upon certificates of Government inspectors. Whether the cold water test is to be sustained or not, the necessity of a thorough examination of boilers, inside and out, is apparent to every intelligent mechanic. The number of explosions caused by defective material and poor workmanship calls for the closest scrutiny by all those purchasing boilers.

American machinery is exported considerably to Great Britain, Germany, France, Sweden, Australia, Cuba, Hayti, Mexico, and all the countries of Central and South America. As fast as railroads are built in the Spanish countries on this continent a permanent machinery trade is developed. Outside capital is generally needed to build and equip railroads, and if it could be diverted for this purpose from the United States to the populous parts of South America and Mexico, our iron mills and machine shops would, undoubtedly, have a gratifying increase of business. Our trade is rapidly extending in that direction, and much of it heretofore controlled by the British is being lost to them.

The managers of the Paris Exposition have been truly liberal in granting 750 awards to American exhibitors. They are classed as follows: 10 grand prizes; 30 diplomas of honor; 135 gold medals; 200 silver medals; 220 bronze medals; and 156 "honorable mentions." Besides these profuse recognitions of merit a number of exhibitors were dubbed Chevaliers, Commanders, etc., in the Legion of Honor. In proportion to the number of entries, the United States carried off the most prizes. This is certainly pleasing to our national vanity, but there may be some lively controversies between rival manufacturers as to which received the "highest award."

Is Government Inspection of Steam Boilers a Failure?

EDITORS AMERICAN MACHINIST:

Your paper has constantly urged upon steam-users the necessity of a thorough examination of their steam boilers, indicating the dangers to which they were exposed, and favoring a practical examination internally and externally, as affording the greatest security against explosion.

The large number of explosions on board steam vessels in our harbor during the past few months by which many lives were sacrificed, and a considerable amount of property destoyed, has again raised the question: Is any security obtained in the Government inspection of steam boilers as conducted by the U. S. Board of Supervising Inspectors who use the hydrostatic test long since condemned and discarded (except as an auxiliary to inspection) by engineers in this and other countries? Condemned—because it fails to discover most of the dangers to which boilers are exposed, and it has frequently happened that disastrous explosions have occurred within a very short time after a boiler had been satisfactory tested. The test of the "Westfield's" boiler was made only a few weeks before it exploded; yet the coroner's inquest showed that the defect that caused that explosion had existed many months, and could have been detected had an examinatior been made.

Chief Engineer Fletcher, of Manchester, England, submitted a report to the select committee of Parliament in 1870, which body was investigating the subject of steam boiler explosions, showing that the explosions in the United Kingdom from 1861 to 1870 were due to the following causes:

40 per cent. to malconstruction.
29 " " " defective condition.
15 " " " rupture of seams over fire.
13 " " " overheating.
2 " " " overpressure.

How many of the above defects would have been discovered by the hydrostatic test?

The experimental explosions at Sandy Hook, in 1870, under the direction of Prof. Thurston, further established the fact that one old boiler, after having been tested to a hydrostatic pressure of 60 lbs., exploded with great violence at a steam pressure of 53 lbs.

The recent explosions in our harbor have all been caused by defects that a proper examination could not have failed to discover. They were as follows:

Steamer "Magenta."

The steam-chimney had corroded away to the thickness and strength of brown paper.

Tugboat "Sam Stanton."

This boiler had over 2,000 square inches of surface on each side, without a brace or stay of any kind, the other parts of the same boiler being braced on areas of less than a square foot, the steam pressure allowed being 65 lbs. The rupture was of the unstayed part following the line of weakness.

Tugboat "A. G. Cattell."

Explosion of a flue that had become so corroded and rotten as to give way at the ordinary working pressure.

By each of the above explosions lives were lost. The boilers had all been tested within a year—in some cases within two months—and were duly certified for their work of death and destruction to those about them. In the case of the "Adelphi" the character and security of the "hydrostatic test" is well shown. Your readers are already familiar with the gross ignorance and carelessness as developed by the Coroner's inquest. I will only call your attention to the fact of the last inspection (so called), being made while there was fire in the furnaces.

The following table, compiled from official reports, compares the work of the U. S. Government Inspection and their system of testing with that of the Hartford Steam Boiler Inspection and Insurance Co., who make thorough examinations inside and outside the boiler, and where defects are found they are interested in having them remedied before explosion take place.

Resulting from the Explosion of Steam Boilers, under the care of the United States Board of Supervising Engineers, compared with that of the Hartford Steam Boiler Inspection and Insurance Company.

STATEMENT OF CASUALITIES

Name of Inspection.	Form of Inspection.	Number of Boilers Inspected Each Year.						Lives Lost by Explosion Each Year.						Damage to Property by Explosion Each Year.					
		1870	1871	1872	1873	1874	1875	1876	1877	1870	1871	1872	1873	1874	1875	1876	1877	1870	1871	1872	1873	1874	1875	1876	1877
U. S. Inspectors.	Hydrostatic Test.	4,498	4,780		5,427	5,698	5,809	5,703	5,863	180	230	.....	10	62	27	61	31	$45,064	$216,200	.....	$4,100	$129,000	$26,350	$81,700	$15,000
Hartford Steam Boiler Insp. & Ins. Co.	Examination and Hammer Test.	2,220	3,266		7,746	8,270	8,705	9,227	9,689	.....	.....	.....	.....	.....	.....	.....	.....	2,500	1,800	.....	10,724	8,654	18,368	10,517	5,541

RECAPITULATION.

U. S. Board of Supervising Engineers.

Total number of boilers tested (7 years)	37,777
Total number of lives lost by explosion (7 years)	601
Total amount of property destroyed by explosion (7 years)	$517,414

Hartford Steam Boiler Inspection and Insurance Company.

Total number of boilers inspected (7 years)	49,123
Total number of lives lost by explosion (*12 years)	25
Total amount of property losses (7 years)	$58,145

*These twelve years represent the whole time since the organization of the Hartford Steam Boiler Inspection and Insurance Company.

The comparison shows conclusively the relative merits of the two kinds of inspection, and I think your readers will agree with me, "That the Government inspection of steam boilers is a failure."

F. B. ALLEN.

MANUFACTURES.

NEW YORK.

Torrance, Merriam & Co., Troy, are doing a good business, and running on full time.

Grahame Hardie, Albany, reports orders plenty, and business improving. He is running his works full time.

The Electric Light Company has been formed in New York with a capital of three hundred thousand dollars, to produce light, heat and power. Tracy R. Edison heads the list of incorporators.

The West Point Foundry Company, of Cold Spring, have about $100,000 worth of work now on hand. One large contract is for a sugar mill for the Island of Porto Rico. They are also building 200 brass mortars, for the life-saving service on the coast.

CONNECTICUT.

Reynolds & Co., New Haven, are running full time, and have done a good trade.

Sawtelle & Judd, Hartford, are doing a good business, and are getting plenty of inquiries for their Independent Air Pump and Condenser, which is giving excellent satisfaction where used.

The Pratt & Whitney Co., Hartford, received the gold medal for the Gardner Machine Gun. They recently shipped Milling and Machine Screw Machines, (for finishing screws and nuts) to the Patent Bolt and Nut Co, at Birmingham, England.

The Pratt & Whitney Co. have presented to the Franklin Institute, Philadelphia, a full set of their Standard External and Internal Gauges, from one quarter to one inch; also a U. S. Standard one-inch Screw Gauge

P. Jewell & Sons, of Hartford, have just made a 36-inch double belt, weighing forty ounces to the square foot, for a Western manufacturing firm. This house, of which Hon. Marshall Jewell is one of the partners, is one of the leading firms in the United States engaged in the production of leather belting, and they are now running on full time.

MASSACHUSETTS.

The Wood & Light Machine Co., Worcester, has been dissolved, and the machinery in their shop is offered for sale.

NEW JERSEY.

Chase & Woodman, Newark, are running their machine shop full time and force on sewing machine work.

The Dixon Crucible Co. received two gold medals and one bronze medal in the distribution of awards at the Paris Exposition.

PENNSYLVANIA.

The car shops, rolling mills, and other manufacturing concerns of Erie, Pa., are employing 2,500 more laborers now than at this time last year.

The Erie shops, at Port Jervis, are crowded with work. In the car shop there are many cars to be overhauled, and in the machine shop a number of engines are in for a general overhauling.

William Sellers & Co., of Philadelphia, are employing 350 hands at present. Besides their New South Wales order, they are filling a large order for New Zealand, and doing some work for South America.

Messrs. Hoopes & Townsend, of Philadelphia, have obtained a gold medal at the Paris Exhibition, the highest award and the only one obtained by any bolt, nut or rivet manufacturer. They report that they are full of orders, and feel encouraged with the present outlook.

The new Blooming mill at the Cambria Iron Works is so nearly completed as to be started to test the machinery. It is a two-high, will roll a 5-inch bloom from an 18-inch ingot, and is driven by a double horizontal engine on the Ramsbottom principle. The engine was the one formerly at the Bessemer Works, at Freedom, now abandoned.

The Baldwin Locomotive Works have received an additional order from the New York Elevated Railroad for thirteen more of the improved pattern locomotives. They are also building several engines for the Kansas Pacific and some for other western railroads.

OHIO.

The Cleveland Rolling Mill Co. are now employing 3,500 men. Ninety days ago they had but 3,200—thus having increased their force 300—a cheering indication of returning prosperity in the iron business, or an industrial "straw" showing which way the wind is blowing in that locality.

Youngstown is one of the most prosperous looking towns in the State. All the mills, blast furnaces and other establishments, are working up to their full capacity.

Business Specials.

Thirty cents a line for each insertion under this head.

The Pratt & Whitney Co., of Hartford, Conn., make a specialty of Cutters for the teeth of gear wheels, that are shaped entirely by machinery and will make interchangeable all gears that are cut with cutters of the same pitch.

For Drop-Forging, Packer Ratchet Drills, Lathe Dogs, Screw Plates and Dies, Address The Billings & Spencer Co., Hartford, Conn.

Frasse & Co., 62 Chatham Street, N. Y. have the most complete assortment of Machine Screw Taps for Machinists, Gunsmiths, Sewing Machine Manufacturers and others, of any house in this country. Also a full line of Chucks, Twist Drills and Fine Tools of every description.

W. H. Warren, Designer and Manufacturer of Special Machinery. Works, 25 Hermon Street, Worcester, Mass.

National Steam Pump, simple reliable and durable. Send for illustrated catalogue with reduced price list. W. E. Kelly & Brother, 46 Cortland St. New York.

Machinery Depot—New, and second hand Iron, and Wood working Machinery and Steam Engines,—E. P. Bullard, 14 Dey St., New York.

The George Place Machinery Agency, 121 Chambers and 103 Reade Sts., New York. Iron Machinery of every description. Patent Cold Rolled Shafting, Pulleys, &c.

The Norcross Steam Damper Regulator, the only reliable pressure Governor in the world, manufactured by The Laflin manufacturing Co., Westfield, Mass.

Address Star Tool Co., Providence, R. I., for Screw Cutting Engine Lathes of 13, 15, 18 and 21 in. swing.

Questions and Answers,

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) S. P., Erie, Pa,, asks how to drill a hole in a pane of glass without a diamond? A. It can be done with a common drill, moistened constantly with spirits of turpentine.

(2) H. S. K., Springfild, Mass., asks (1) is there any rule for lining up shafting from the main shaft to other parts of the mill? also, (2) is there a rule for cutting belt holes through the floor?

A. (1) With pieces of cord and a square, lines can be laid off, parallel, or perpendicular, to the line of the main shaft. (2) By making a diagram, and finding the angle of the belt, the positions for the holes can be ascertained by using a string and bevel.

(3) R. J. I., Albany, N. Y., asks, will you please inform me how I can get a thin coating of rubber on a solid object like a block of wood? A Dissolve rubber in bisulphide of carbon and apply as a varnish.

(4) M. D. O., Milwaukee, Wis., says, I am about renting steam to a new tenant, who wants to know what I will charge for an inch pipe per hour. he to keep the valve wide open, at a pressure of sixty pounds. Is there any rule for finding the velocity of steam at any given pressure? A. No rule that will give the discharge from a steam pipe can be given, except where the difference of pressure at the two extremities is known. Steam may rush out with a velocity of nearly 2,000 feet per second, or it may have any less velocity, down to zero, as the difference of pressure decreases. An inch steam pipe. if quite short, would drive about a four-inch cylinder, as usually proportioned. Ascertain, as nearly as possible, what amount of power the tenant can use, as an average, and ch rge for it, trusting to his business capacity for his ability to get an equivalent for what he pays.

(5) D. N. L., New Haven, Conn., asks, can you give me the simplest and best method of tinning cast and wrought iron, and also of what material the tanks for melting the tin in should be made? A. Hooks-and-eyes, pins, etc., are tinned by being boiled in a tin boiler filled with water-granulated tin, and cream of tartar. They are then dried by being rubbed with sawdust, or bran. In tinning sheet iron, the iron is thoroughly scoured, and immersed in baths of molten tin, covered with a layer of molten tallow to prevent oxidation of the metal. They are next immersed in molten tallow to remove any excess of tin, wiped with a brush of hemp, and cleaned with bran. A one-sixteenth part nickel renders the tin less fusible.

(6) F. T. B., Chicago, Ill., asks, will you kindly inform me how to turn off solid emery wheels? A. One method is, to place a tin pan with some hot water just under the wheel, so as to keep the face wet, then turn them off with a piece of ⅜-inch square steel; let the wheels stand several hours after to dry.

Machinists' and Engineers' Supplies.

The condition of trade is fair, and prices, as a rule, hold their own without material advance. A new ratchet drill and a new upright hand drilling machine, both involving a new principle in feed, will shortly be placed upon the market. The new Leader Lathe for foot power, just brought out by Frasse & Co., 62 Chatham St., is offered at $30; with hollow spindle $1 extra. The Circular Sawing Attachment is sold at $12 and the Scroll Sawing Attachment at $7. Lathe with both attachments, $45.

C. H. Delamater & Co. (salesroom 10 Cortlandt St., New York) have issued a new price list of Kennedy's Patent Concentrated Power Shearing and Punching Machines, which shows an average of 10 per cent. reduction. The punching machines are furnished with Kennedy's Patent Spiral Punch for all work from a quarter inch hole upwards. The bar shears are made in three sizes at $10, $20 and $60, cutting from ¼x1½ in. bar, and ⅜ in. round, to ⅜x4 in. bar and ⅝ in. round iron. The plate shears are of three sizes at $30, $60, and $110, cutting from ¼ to ⅛ in. sheet any width, and ⅜ to ¾ round iron. Three sizes of punches at $25, $50 and $75, punch up to ½ in., and smaller holes in 5-16 in. iron, 6 in. from edge to centre of hole. There are also three sizes each of the Flange Punch and the Screw Punch.

The following Circular explains itself.

Office of the Worcester Machine Screw Company,
Worcester, Mass.
November 15th, 1878.

To Machine Manufacturers:

Wishing to increase the sales of our Set, Cap and Machine Screws, Engine Studs, &c., we have fitted up our factory with the New Automatic Screw Machinery, and are now furnishing these goods at very much lower prices than formerly. We are the exclusive owners of valuable improvements in Screw Machinery, and propose to give our customers the benefit of first-class work at low prices.

With our improvements, and the large number of Machines now ready to operate, we are prepared to fill large orders of Special as well as Standard goods very promptly.

We wish to call the attention of Steam Engine and Tool builders to our facilities for the manufacture of Milled Work, such as Square and Hexagon Head Cap or Collar Screws, they being made from the solid bar, and Heads milled true to gauge, when required. Also to our improved method of Case-Hardening, whereby we are able to produce some of the finest colors, and at the same time thoroughly harden the work. Our Machine Screws we shall continue to furnish as low as any other makers; and shall use none but the best of material.

We have all the latest improvements for the manufacture of these goods, and were the first to introduce a system of Standard Gauges; and by cutting the Threads with Solid Dies, are able to furnish a uniform class of work.

We furnish Taps made expressly for our Screws, and warrant them correct in every particular.

Parties using any of the above class of goods in large quantities, will do well to get our prices before placing their orders elsewhere.

☞ For convenience of shipping,&c., we have arranged with our general agents, Messrs. H. S. Manning & Co., 111 Liberty St., New York, to handle our goods exclusively in all but the New England States, they carrying a large stock of all our Standard Goods, and will sell at Factory Prices.

WORCESTER MACHINE SCREW CO.

In Boiler Makers' Supplies there is a fair trade without any change in prices

---

MOORE'S UNIVERSAL ASSISTANT,

Or 50,000 Industrial Facts,

Rules, Processes, Business Forms, etc., in over 200 Trades. Contains nearly 30,000 items in Gas, Steam, & Civil Engineering, Machinery Construction, Metal & Woodworking Processes, Mining, and all Mechanical Trades. Full details for Engineers, Master Mechanics, Machinists, Boiler Makers, Millers, Millwrights, Ship-Builders, Navigators, Mill-Owners, Contractors, Builders, Plumbers, Steam & Gas Fitters, Tin, Copper & Sheet Iron Workers. Pattern Makers, Moulders, Bronzers, Gilders, etc. Speed of Trains, Wheels, Pulleys, Drums, Saws, Cutting, Turning, Boring, Planing & Drilling Tools, Saw Filing, Forging, Tempering, Welding, Annealing, Case-hardening, Tool, Spring & Instrument making, Finishing, Gear-cutting, Lathe-gearing, Screw-cutting, Wheel-gearing, Bevel-gears, Shafting, Belting, Friction, Pitch of Wheels, Diam. &c., of Circles, Locomotive & Car-Construction, Gas & Water Works, Hydraulics, Horse-power of Streams, Mill-dams, Water-wheels, Cotton Gins, Presses, Explosives, &c., 418 receipts for Alloys & Solders, 96 for Bronzes, Dips, Lacquers, etc. 78 for Brassing, Japanning, Tinning, Galvanizing, etc. Contractors' & Engineers' TABLES, Power of Steam, Water, Wind, effects of Heat, Shrinkage of Castings, Fuel Values, Expansion of Metals, Strength of Materials, No. of Bricks in Walls, arrangement & Speed of Flour, Oatmeal, Saw, Shingle, Paper, Cotton, Woolen & Fulling Mill Machinery, Sugar, Oil, Marble, Threshing & Rolling Mill do. Strength of Teeth, Engine Building, Setting of Valves, Link and Valve motion, Eccentrics, Scale Preventives, Steam Pipe & Boiler Covering, Cements, Steam-heating, Ventilation, Gas-Economy, Tinners' Tables, Builders', Roofers', Painters' & Plasterers', do. Weather, do. Growth of Timber, Logging, Mechanical Facts, etc. On Blast Furnaces, Iron & Steel Manufacture. On Prospecting, Gold and Silver Mining, Sweep-Smelting, Amalgamating, etc. 443 ENGRAVINGS of Mill & Steam Machinery, Tools, Sheet Metal Work, Mechanical Movements, Printing Presses, Plans of Buildings, Roofs, Bridges, Portraits of Inventors, etc. 1,000 items for Grocers, Confectioners, Druggists, Physicians, Dentists, etc., 300 Health Items, 400 do. for Hunters, Trappers, Tanners, Leather and Rubber Work. Detailed Instructions for Watchmakers, Jewelers, Gilders, etc. 800 items for Printers, Publishers, and Writers for the Press. Authors' Reference Tables, 500 items for Painters, Varnishers, Polishers & Gilders. On Book-keeping, Telegraphy, and Photography, full details. Advice to Merchants, how to do Business. 450 TABLES, with 500,000 Calculations in all possible forms, for Mechanics, Merchants & Farmers. New Process Milling, High ground, or Patent flour, 10,000 items for Householders, Farmers, Stock Owners, Bee-keepers, &c. To break, train & shoe Horses, Remedies for Horses & Cattle, Food Values, Care of Farm Stock, Rural Economy, Soiling of Stock, on Bee-keeping, to secure large Crops, renew old Orchards, reduce Bones, Fertilizers, full details, Pest Poisons, Steam-power on farms, Standard & Metric Systems of Weights & Measures, Specific Gravities, Weight of Water, Metals, Timber, etc. Exchange Tables, Value of Coins, Freights by rail & water—a car load, Stowage in Ships, Lightning Calculator for Cubic Measures, Ready Reckoner, Produce, Rent, Board, Wages, Interest, Coal & Tonnage TABLES. Land Surveying, Grain, Hay & Cattle Measurement, Seed, Ploughing, Planting & breeding Tables, Contents of Granaries, Cribs, Tanks, Cisterns, Boilers, Logs Boards, Scantling, Lumber Surveying, etc., *at sight*. 10,000 Trade Secrets, Scientific Facts, Business Forms, etc. Patent Office Rules, Information for Inventors, etc., etc.

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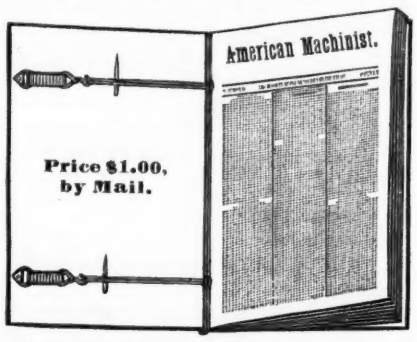

We are now prepared to offer to our readers who wish to preserve files of the paper the

Monitor Binder,

shown in the above cut which we have selected as the best one offered to the public. The price for neat cloth covers, to hold 24 numbers (2 years), with the name **American Machinist** stamped on the front (outside), will be $1.00 each, mailed post paid in the United States and Canada, and 75 cents each delivered at our office, 75 Fulton Street.

MILLER & BAILEY,
Editors and Proprietors.

Trade Ⓑ Mark.

CAUTION!

A Lathe Dog, similar in appearance to the Billings' Lathe Dog, but inferior in quality, being made of casting, is offered in the market. We guarantee the Billings' Lathe Dog to be forged of wrought iron and bar steel. Buyers can readily recognize the genuine article, as they are all stamped with our trade mark as above.

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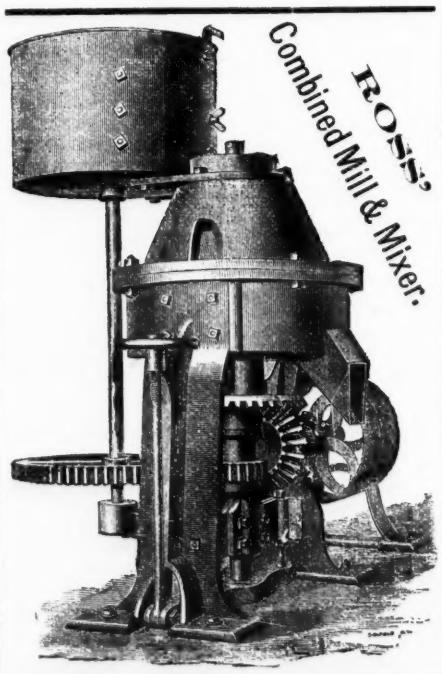
ESTABLISHED 1852.

Patents procured in the U.S. & Europe.



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THE BEST

Burr Stone Mill in the World,

For White Lead, Paint, Coach Colors, Paris White in Oil, Water or Varnish, Printing Inks, Chocolate, Paste, Blacking, Axle Grease, &c.

Also for Flour, Feed, Drugs, Spices, Dry Paints, &c.

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Patent Automatic Cut-Off Steam Engine.

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The Most Economical in the Use of Fuel,
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Altogether the Best Cut-Off Engine in Market.

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For City Water Works; also for Manufacturing purposes, etc.

(*highest duty guaranteed.*)

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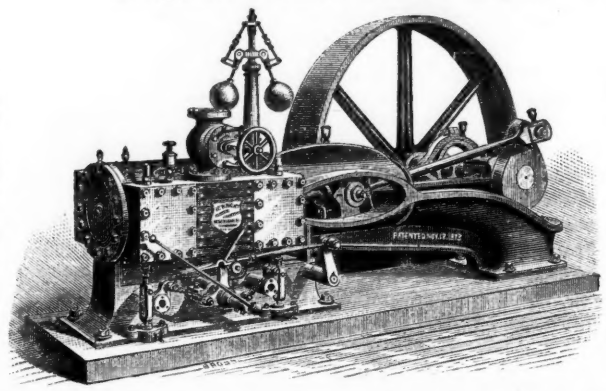

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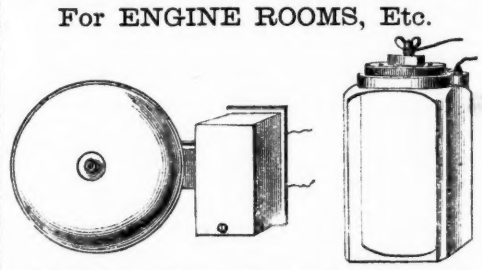
LIGHT AND HEAVY FORGINGS, SHAFTING, PULLEYS, HANGERS, MILL WORK, IRON AND BRASS CASTINGS, &c.

A LARGE GENERAL ASSORTMENT OF PATTERNS ON HAND.

VIBRATING GONG AND BATTERY

For ENGINE ROOMS, Etc.



Adapted to Water, Oil, Gas, or Steam under pressure, high and low, and used as a *Standard of Pressure* Hundreds in use on land and water.

The "Alarm Gong" ringing at the boiler *prevents explosions, and saves both life and property.*

For Pamphlet apply to

SAFETY GAUGE FOR OFFICE.

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BEST STEAM PUMP IN AMERICA.

MORE THAN 4,000 IN USE.

THE "DEANE."

MADE BY THE HOLYOKE MACHINE CO.

BOILER FEED PUMPS, FIRE PUMPS, MINING PUMPS, BREWERY PUMPS, WATER-WORKS PUMPS, MARINE PUMPS, OIL LINE PUMPS, AIR PUMPS, PLUNGER PUMPS, RAILROAD PUMPS, HYDRAULIC-PRESSURE PUMPS, SUGAR-HOUSE PUMPS, TANK PUMPS, BILGE PUMPS, CIRCULATING PUMPS, BOILER AND PUMPS, DEEP-WELL PUMPS, OIL REFINERY PUMPS, FLY-WHEEL PUMPS, LOCOMOTIVE PUMPS, &c.

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Manufacturers of

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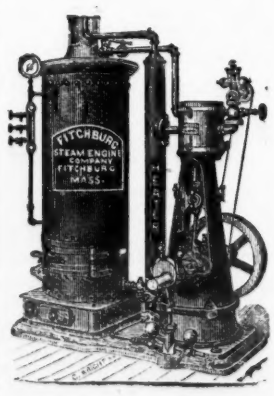

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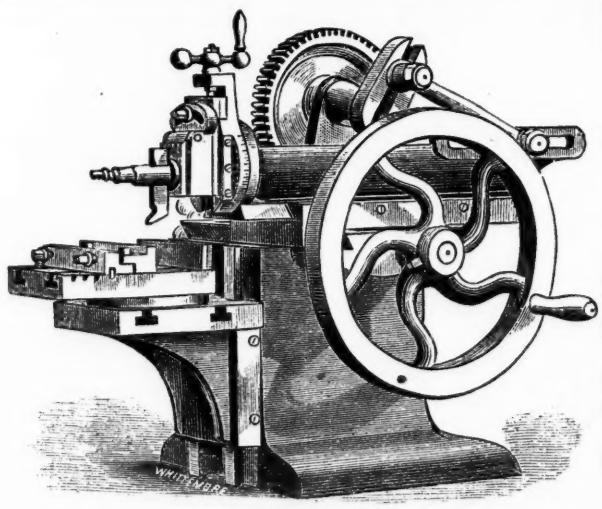

Hand-Shaping Machine,

Manufactured by

E. N. BOYNTON,

WORCESTER, MASS.

This machine has a stroke of six inches, and may readily be adjusted to work of any less distance.

Length of Traverse, eight inches. Vertical adjustment of table, three inches.

Can be run by hand or power.

Weight, 225 lbs.

Ashcroft's Patent Self-Cleansing Steam Trap

FOR PERMITTING AIR AND WATER OF CONDENSATION TO ESCAPE FROM STEAM PIPES WITHOUT LOSS OF STEAM.

APPLICABLE ALSO FOR THE SAME PURPOSE TO HIGH AND LOW PRESSURE STEAM ENGINES, STEAM PRESSES, STEAM HAMMERS, STOVES, DRYING CYLINDERS, DRESSING MACHINES,

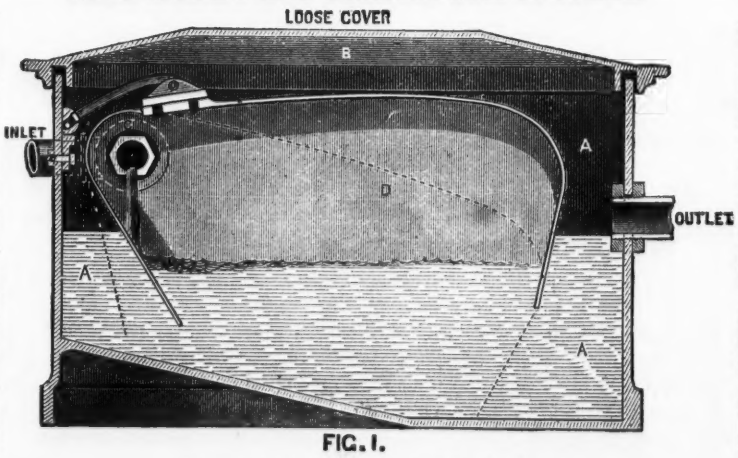

FIG. I.

STEAM WORMS, SUGAR PANS, COMBING MACHINES, WOOL DRYERS, TENTERING MACHINES AND STEAM APPARATUS GENERALLY.

For summary of advantages send for circular to

THE ASHCROFT MF'G CO., 51 and 53 Sudbury and 8 and 10 Bowker Streets, Boston, U. S. A.

E. H. ASHCROFT, President and Treasurer.
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CHARLES A. MOORE, General Manager.
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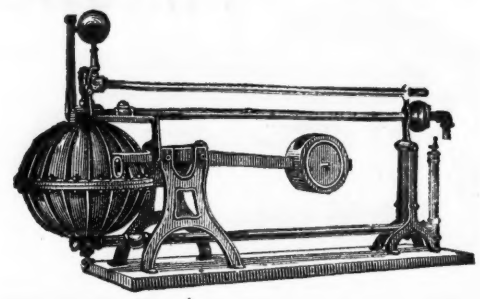
THE ALBANY STEAM TRAP.



This Trap automatically drains the water of condensation from HEATING COILS, and returns the same to the Boiler, whether the Coils are *above or below* the water level in Boiler, thus doing away with pumps and other mechanical devices for such purposes. Apply to

Albany Steam Trap Co.,

ALBANY, N. Y.

C. D. P. GIBSON. E. W. CRANE. O. H. MAYNARD.

AMERICAN

Electric Gas-Lighting Company,

MANUFACTURERS OF THE ONLY PERFECT

Apparatus for Lighting Gas by Chemical Electricity.

PERFECT SAFETY FROM FIRE.

EACH BURNER LIGHTED AND EXTINGUISHED SEPARATELY, if desired, by the most inexperienced, and WITHOUT POSSIBILITY of SHORT-CIRCUITING THE BATTERY—Points not hitherto attained.

WE ALSO MANUFACTURE

"THE CELEBRATED AUTOMATIC BURGLAR ALARM."

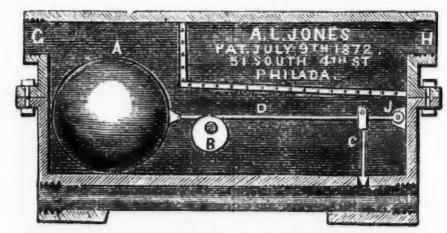
CALL AND SEE IT AT

No. 182 Broadway, New York, Room No. 5.

Improved Self-Regulating Steam Trap,

A TRIAL IS ALL THAT IS NECESSARY TO SECURE ITS ADOPTION.

Now on Exhibition at the American Institute Fair, New York City.



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SEND FOR CIRCULAR.

WM. E. KELLY & BRO.

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ACME

DROP FORGED STEEL

LATHE DOG.

STRONGEST,

CHEAPEST,

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Lathe Dog in the Market.

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Superintendent of the Washburn Machine Shop.

Send for Circular. **WORCESTER, Mass.**

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P. O. BOX 4627,

Have the best assortment of sizes and threads in

Taps AND Dies

For Machine Screws of any house in this country.

ALSO,

A Full line of Machinists' Tools & Supplies.

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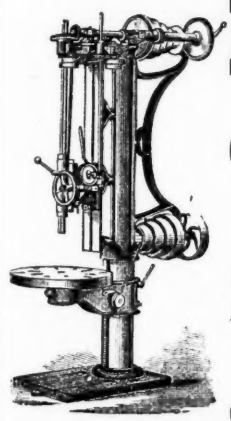

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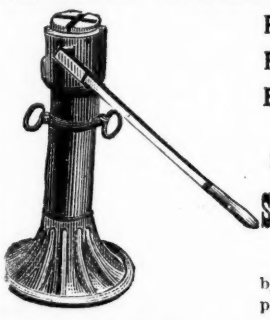

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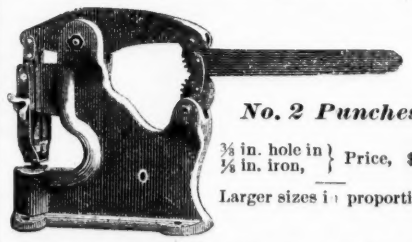

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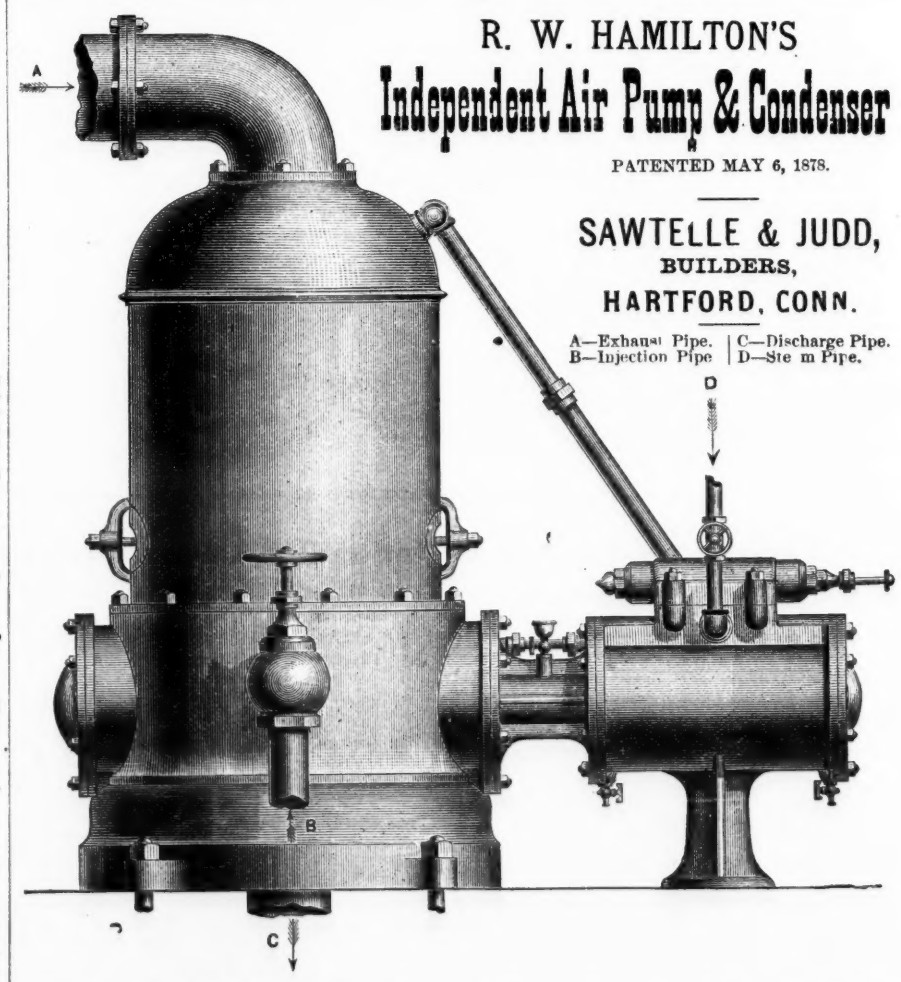

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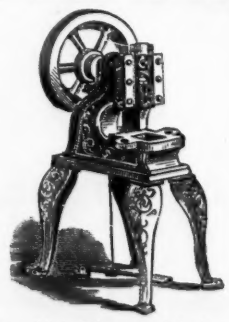

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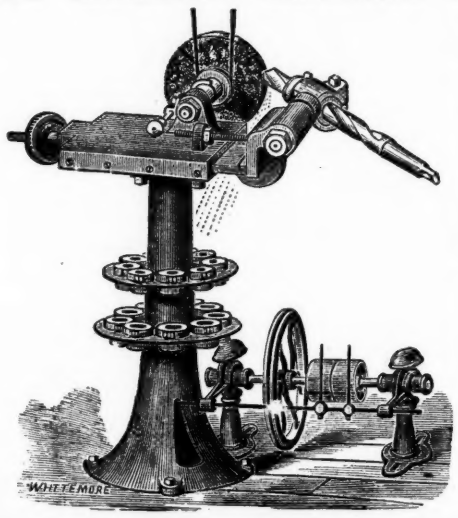

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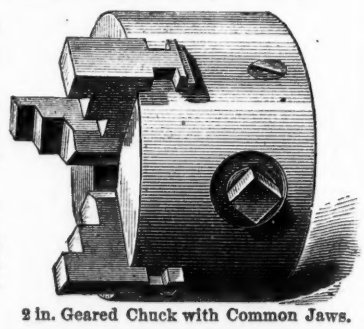

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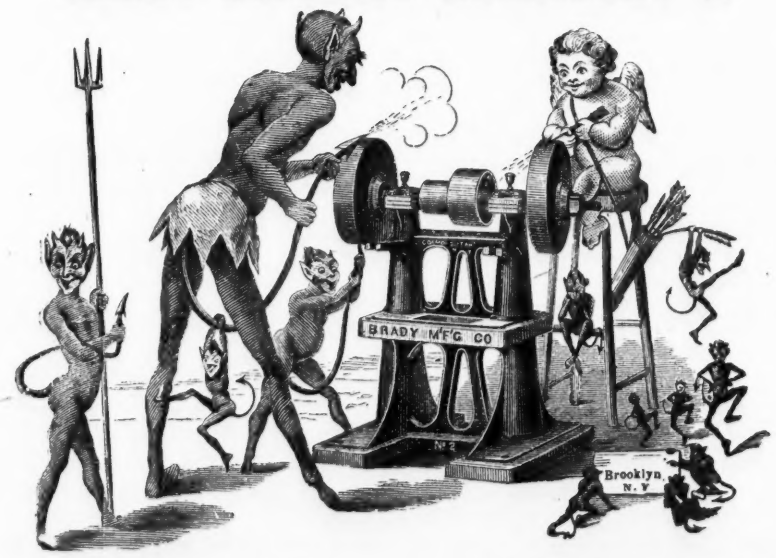

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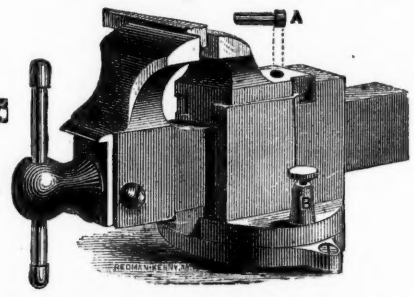

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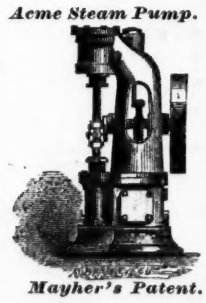

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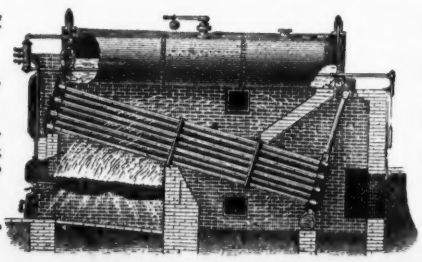

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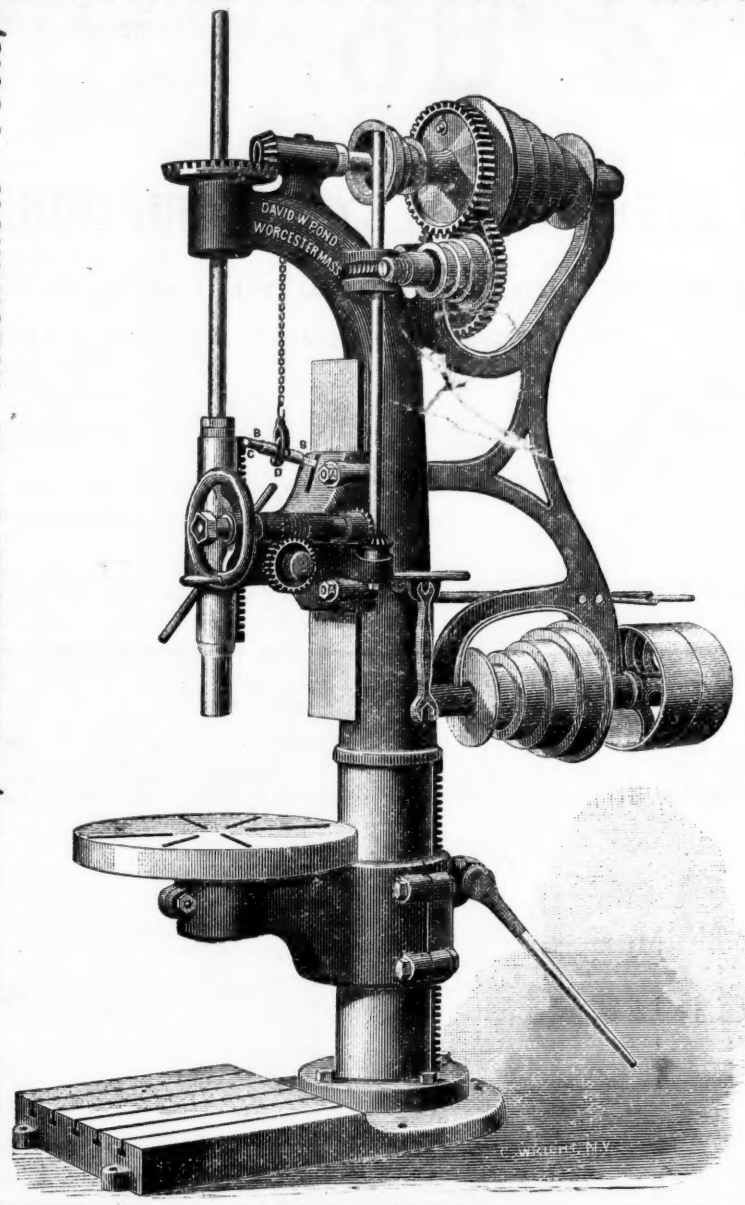

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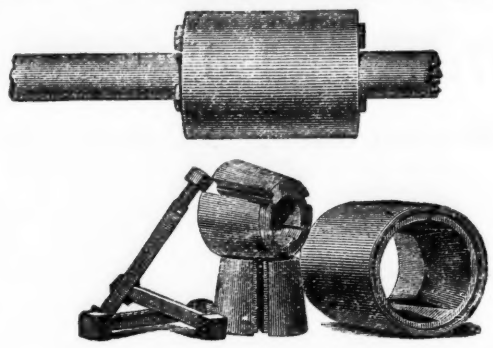

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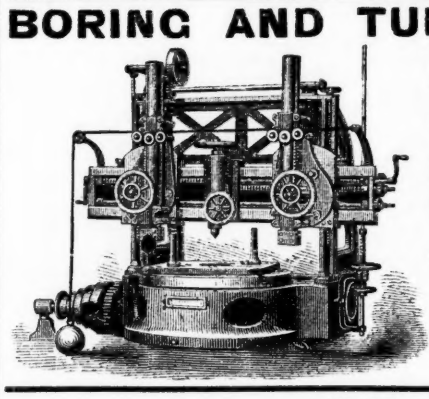

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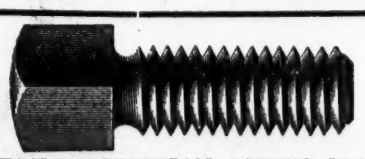

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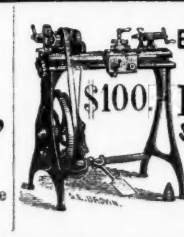

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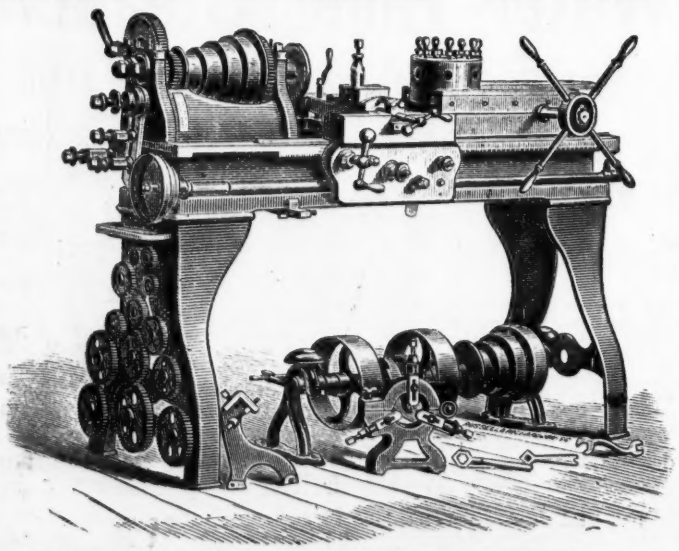

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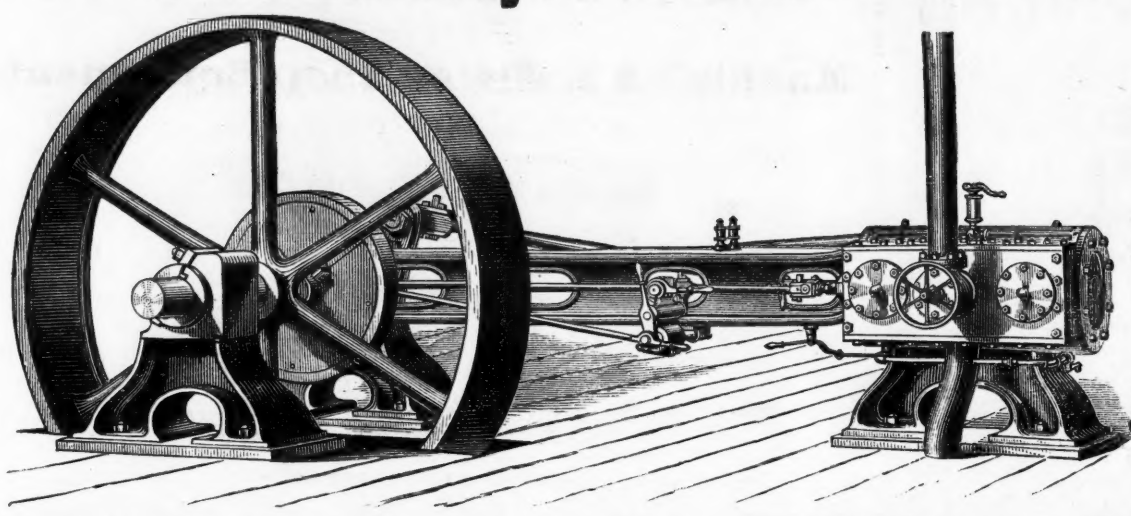

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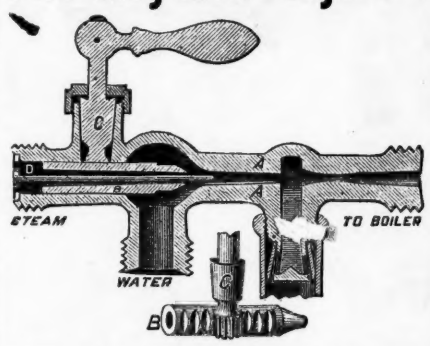

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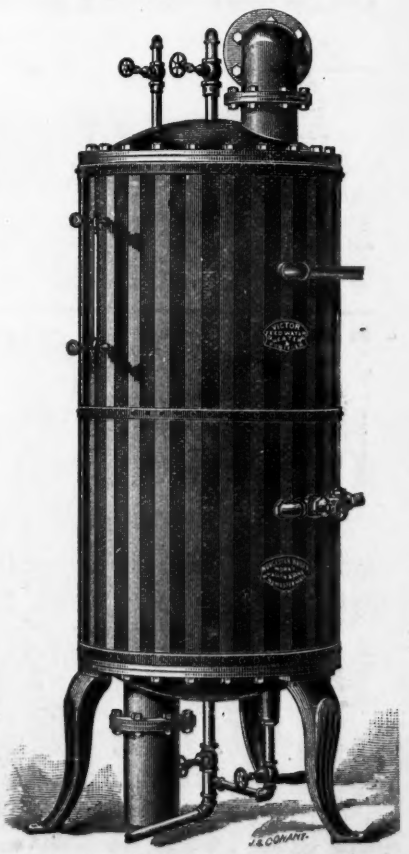

(Jones' Patent, Nov. 6, 1877.)

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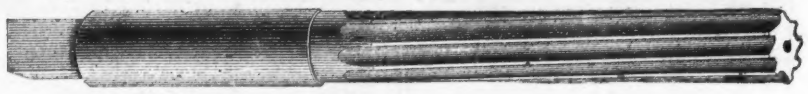

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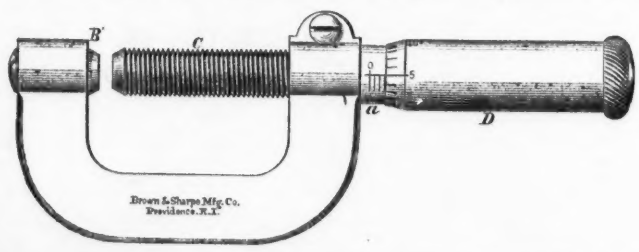

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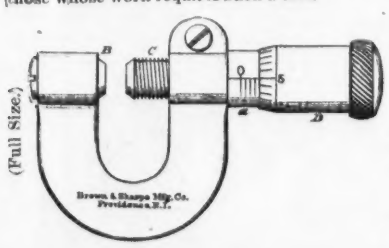

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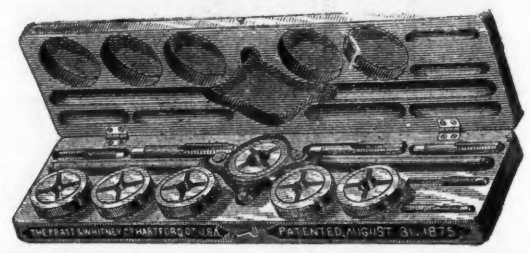

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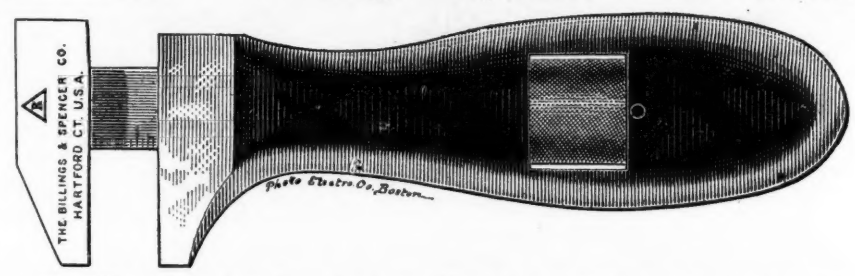

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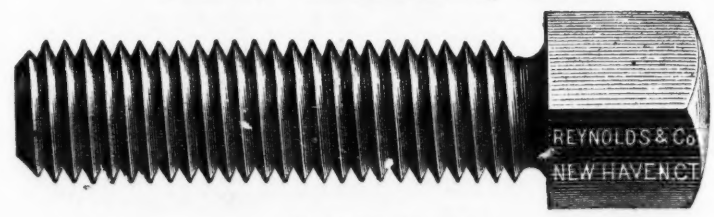

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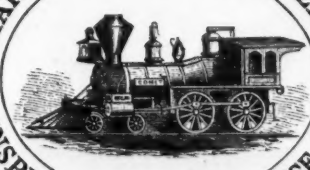

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